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(71) 出願人 000003078

株式会社東芝  
東京都港区芝浦一丁目1番1号

(72) 発明者 森谷 修

東京都港区芝浦一丁目1番1号 株式会社  
東芝本社事務所内

(72) 発明者 熊木 良成

神奈川県川崎市幸区小向東芝町1番地 株  
式会社東芝研究開発センター内

(74) 代理人 100083806

弁理士 三好 秀和 (外7名)

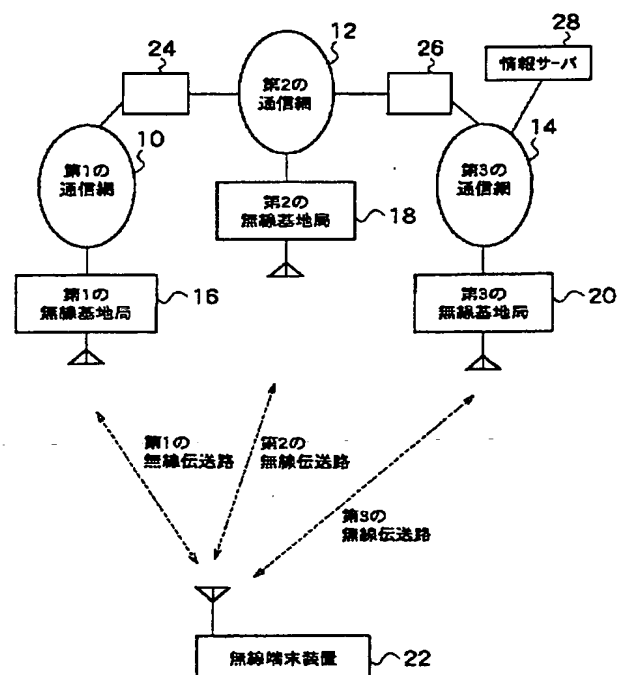
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(54) 【発明の名称】 無線端末装置、無線通信システム

(57) 【要約】

【課題】 アプリケーションの内容や、通信の状態、利用者の状態、周りの環境条件等に応じて、接続先の無線通信システムを自動的に切り替え可能な無線端末装置を提供する。

【解決手段】 異なる通信方式を採用する複数の通信網10、12、14それぞれと接続可能であり、複数の通信網10、12、14のうちのいずれかとの間で通信する際に、無線基地局16、18、20との間で形成される無線伝送路のうちから、所定の無線伝送路選択基準に基づいて、最適な無線伝送路を随時選択可能な最適無線伝送路選択手段を備えた無線端末装置22である。



1

## 【特許請求の範囲】

【請求項 1】 異なる通信方式を採用する複数の無線通信システムそれぞれと接続可能な無線端末装置であつて、

前記複数の無線通信システムのうちのいずれかとの間で通信する際に、前記複数の無線通信システムそれぞれの無線基地局との間で形成される複数の無線伝送路のうちから、所定の無線伝送路選択基準に基づいて、最適な無線伝送路を随時選択可能な最適無線伝送路選択手段を備えることを特徴とする無線端末装置。

【請求項 2】 前記複数の無線通信システムそれぞれに接続された複数の通信先装置のうちから、所定の通信先装置選択基準に基づいて、最適な通信先装置を随時選択可能な最適通信先装置選択手段を更に備えることを特徴とする請求項 1 に記載の無線端末装置。

【請求項 3】 前記通信先装置への接続は、前記複数の無線通信システムのうちの少なくとも 2 つを介して実現されることを特徴とする請求項 2 に記載の無線端末装置。

【請求項 4】 前記複数の無線伝送路および無線通信システムのうちから、所定の接続経路選択基準に基づいて、前記通信先装置への接続に利用される最適な無線伝送路および無線通信システムを随時選択可能な最適無線経路選択手段を更に備えることを特徴とする請求項 3 に記載の無線端末装置。

【請求項 5】 前記無線伝送路選択基準、通信先装置選択基準および接続経路選択基準それぞれは、前記無線端末装置の状態、前記無線端末装置の利用者の状況、前記無線端末装置と前記通信先装置との間での通信内容、前記通信先装置の状況、前記無線伝送路の状態、および、前記無線端末装置と前記通信先装置との間での通信に要する費用または消費電力、のうちの少なくとも 1 つを含むことを特徴とする請求項 4 に記載の無線端末装置。

【請求項 6】 表示画面を有する無線端末装置と、該無線端末装置との間で第 1 の無線伝送路を形成する第 1 の無線基地局を備えた第 1 の通信網と、前記無線端末装置との間で前記第 1 の無線伝送路より低速の伝送速度を有する第 2 の無線伝送路を形成する第 2 の無線基地局を備えた第 2 の通信網とを含み、前記無線端末装置は、重力方向を検知する検出器と、該検出器からの検出結果に基づいて、前記表示画面の表示方向と前記無線端末装置の利用者の視線との相互関係を判定する手段と、該判定手段からの判定結果に基づいて、前記第 1 および第 2 の無線基地局のうちのいずれと接続するかを選択する手段とを備えることを特徴とする無線通信システム。

【請求項 7】 前記決定手段は、前記表示画面の表示方向と前記利用者の視線とが一致すると判定された場合には、前記第 1 の無線基地局との接続を選択し、前記表示

2

画面の表示方向と前記利用者の視線とが一致しないと判定された場合には、前記第 2 の無線基地局との接続を選択することを特徴とする請求項 6 に記載の無線通信システム。

【請求項 8】 公衆網であつて、第 1 の無線基地局を備えた第 1 の通信網と、

該第 1 の通信網と同一の通信方式を採用するローカルエリアネットワークであつて、第 2 の無線基地局を備えた第 2 の通信網と、

10 前記第 1 および第 2 の無線基地局それぞれに接続可能な無線端末装置とを含み、

前記第 1 および第 2 の無線基地局それぞれは、前記無線端末装置との通信の際に、前記第 1 および第 2 の無線基地局それぞれに固有の識別情報を通知し、

前記無線端末装置は、前記識別情報の通知によって、接続先無線基地局を識別し、最適な接続先無線基地局を選択することを特徴とする無線通信システム。

【請求項 9】 前記無線端末装置は、前記無線端末装置の位置情報を取得する手段を、更に備えることを特徴とする請求項 8 に記載の無線通信システム。

【請求項 10】 無線基地局を備えた通信網と、該無線基地局と接続可能な第 1 の無線端末装置と、該第 1 の無線端末装置と接続可能で、かつ、前記無線基地局と接続不可能な第 2 の無線端末装置とを含み、

前記第 2 の無線端末装置の内部に保持されたデータは、前記第 1 および第 2 の無線端末装置との間での接続によって、前記第 1 の端末装置の内部に一旦保持され、さらに、該一旦保持されたデータは、前記第 1 の無線端末装置および無線基地局との間での接続によって、前記通信網に送出されることを特徴とする無線通信システム。

【請求項 11】 前記第 2 の無線端末装置は、前記無線基地局の通信エリア外に配置されている、または、前記無線基地局との間に形成された無線伝送路が遮断されていることを特徴とする請求項 10 に記載の無線通信システム。

【請求項 12】 無線基地局を備えた通信網と、該無線基地局と接続可能な第 1 の無線端末装置と、該第 1 の無線端末装置と接続可能で、かつ、前記無線基地局と接続不可能な第 2 の無線端末装置とを含み、

40 前記通信網から送出されたデータは、前記無線基地局および第 1 の無線端末装置との間での接続によって、前記第 1 の端末装置の内部に一旦保持され、さらに、該一旦保持されたデータは、前記第 1 および第 2 の無線端末装置との間での接続によって、前記第 2 の無線端末装置に送出されることを特徴とする無線通信システム。

【請求項 13】 前記第 2 の無線端末装置は、前記無線基地局の通信エリア外に配置されている、または、前記無線基地局との間に形成された無線伝送路が遮断されていることを特徴とする請求項 12 に記載の無線通信システム。

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3

【請求項14】 複数の無線基地局を備えた通信網と、前記無線基地局それぞれと接続可能な無線端末装置と、あらかじめ指定された前記無線端末装置の複数の接続先それぞれを特定する情報が記載されたテーブルを備え、該テーブルを参照して前記無線端末装置の接続先を選択する接続先選択手段とを含む、

前記無線端末装置は、前記無線端末装置の利用者の状態を随時監視する手段と、該利用者が危険な状態にあると検知した場合には、緊急信号を送出する手段とを備え、前記接続先選択手段は、前記無線基地局のいずれかを介して送信される前記無線端末装置からの緊急信号を受け取った場合に、前記無線端末装置の接続先を選択することを特徴とする無線通信システム。

【請求項15】 前記接続先手段は、前記利用者の家庭内に接地された前記無線基地局と前記通信網との間に接続されたゲートウェイサーバ内に設けられることを特徴とする請求項14に記載の無線通信システム。

【請求項16】 前記接続先手段は、前記通信網に接続されたサービスプロバイダ内に設けられることを特徴とする請求項14に記載の無線通信システム。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、無線端末装置、無線通信システム、および、無線通信方法に関する。

【0002】

【従来の技術】従来の無線通信システムは、システムごとに別々の周波数を用いて通信が行なわれていた。このため、無線端末は、それぞれが利用される無線通信システムに固有の端末であり、対応する無線通信システムのみに接続可能である。一方、端末によっては、複数の種類の無線通信装置をあらかじめ内蔵し、複数の無線通信システムに接続可能なものもあるが、一度には一つのシステムにしか接続することはできなかった。また、無線通信装置の切り換え自体も、無線端末の利用者の手動によって行われていた。

【0003】図18に示す無線通信システムでは、2つの通信網、ここで、PHS網1000とPDC網1002、に接続可能である、デュアルモード端末と呼ばれる無線端末装置1004が利用されている。もの無線端末装置1004には、表示部1006と、テンキー1008と、PHS網1000用の無線アンテナ1010と、PDC網1002用の無線アンテナ1012と、が備え付けられている。また、PHS網1000およびPHS網1002それぞれには、無線基地局1014、1016が接続され、各無線基地局1014、1016を介して、無線端末装置1004はPHS網1000およびPDC網1002に無線接続する。PHS網1000およびPDC網1002は、それぞれに対応するアクセスサーバ2109を介して、公衆網であるインターネット1020と接続している。

4

【0004】無線端末装置1004は、たとえば、無線アンテナ1010を利用してPHS網1000に接続し、PHS網1000と接続する通信先の端末1022と音声通話を行なうことが可能である。また、無線アンテナ1012を利用してPDC網1002に接続し、PDC網1002と接続する通信先の端末1024と音声通話を行うことも可能である。さらに、アクセスサーバ1018との間でデータ通信回線を確立し、インターネット1020を経由して、所望の情報サーバ（WWWサーバ）1026にアクセスすることもできる。情報サーバ1026内の情報は、PHS網1000またはPDC網1002のいずれかを經由して無線装置端末1004に送信され、無線端末装置1004の表示部1006に表示されることになる。

【0005】上記の場合、無線端末装置1004の接続先、つまり、PHS網1000とPDC網1002のうちのいずれに接続するかは、テンキー1008などを用いた利用者による入力によって選択されている。すなわち、その選択は、利用者の意志によるものである。したがって、たとえば、利用者が音声通信を行うときに、サービスエリアが広く、また、高速な移動にも適応可能であるPDC網1002を選択するか、あるいは、データ通信の伝送速度の速いPHS網1000を選択するかは、まさに利用者の決定によるものである。このため、たとえば、音声通話する際にPHS網1000が選択された結果、移動中にその通信が切断されてしまったり、あるいは、データ通信にPDC網1002が選択され、その結果、データ伝送速度が低い上に料金も高く請求されてしまう場合があった。

【0006】また、図19に示すPC装置1028では、PHSデータ通信カード1030および無線LANカード1032の両方が、PC装置1028のPCMCIAカードスロットアイコン1028aに接続する。PHSデータ通信カード1030はPHS端末1034と接続し、無線LANカード装置1032は、アンテナ部1032aを介して、親機1036と接続している。PC装置1028は、無線LANカード1032、親機1036、イーサネット1038、構内網1040、および、ゲートウェイ1042を介して、インターネット1044に接続された情報サーバ（WWWサーバ）1046にアクセスする。あるいは、PHSデータ通信カード1030、PHS端末1034、基地局1048、PHS網1050、および、アクセスサーバ1052を介して、情報サーバ1046にアクセスすることも可能である。また、PHS網1050に接続された通信先の端末1054とも通信可能である。

【0007】図19のPC装置1028の接続先、つまり、構内網1040とPHS網1050のうちのいずれに接続するかは、PC装置1028のディスプレイ装置に表示され、構内網104およびPHS網1050それ

5

それぞれに対応するアイコン 1028b をマウスカーソル 1028c によってクリックすることで決定される。さらに、PC 装置 1028 内の WWW ブラウザなどのソフトの操作によって、情報サーバ 1046 の情報をダウンロードすることもできる。

【0008】この場合であっても、上記の図 18 に示した場合と同様、PC 装置 1028 の利用者が、PC 装置 1028 の接続先を選択することで、無線通信が実行される。また、一度選択された接続先は、通信中には自動で切り換えることができない。このため、たとえば、構内網 1040 に接続されている PC 装置 1028 が屋内に移動し、そのため、PHS 網 1050 に接続を切り換える必要が生じた場合であっても、一旦構内網 1040 との通信を切断してから PHS 網 1050 に再接続する必要がある。したがって、利用者には煩雑な操作が要求されることになる。

【0009】また、上記の図 18 および図 19 の場合の両方に共通する問題として、無線機を 2 台切り換える際に、それぞれの無線機が独立であるため、無線機の物理層、MAC 層がそれぞれ必要であるという問題がある。さらに、図 19 の場合では、データ通信用のロジック LSI などとも両方に必要であるため、無線機の重量、消費電力、価格コストがほぼ 2 台分必要になるなどの問題もあった。

【0010】さらに、従来は無線周波数ごとに別々のシステムが構築されてきたが、2.4GHz 帯では、IEEE 802.11 だけでなく、ホーム RF や Bluetooth といった複数のシステムが同一の周波数帯を利用している。しかし、それぞれのシステムの機器は独立であるため、上記と同様、同一周波数帯であっても、図 19 に示すように、複数の無線端末を接続する必要がある。そして、5.2GHz 帯や 5.3GHz 帯においても、同様に、複数の無線システムが周波数を共有する見込みである。

【0011】また、無線端末装置の無線機の切り替えは、利用者の手入力で行われるために、場所が変わるたびに接続する無線通信システムを変更しなければならない。同一場所においても通信内容が異なる場合には、やはり無線機を切り換える必要があった。さらに、同時に複数の無線機を選択できないため、画像を見ながら電話をかけるといった複数のコンテンツの通信を実現することができなかった。

【0012】

【発明が解決しようとする課題】本発明は、このような課題を解決し、アプリケーションの内容や、通信の状態、利用者の状態、周りの環境条件等に応じて、接続先の無線通信システムを自動的に切り替え可能な無線端末装置を提供することを目的とする。

【0013】

【課題を解決するための手段】上記課題を解決するた

6

め、本発明は、異なる通信方式を採用する複数の無線通信システムそれぞれと接続可能な無線端末装置であって、前記複数の無線通信システムのうちのいずれかとの間で通信する際に、前記複数の無線通信システムそれぞれの無線基地局との間で形成される複数の無線伝送路のうちから、所定の無線伝送路選択基準に基づいて、最適な無線伝送路を随時選択可能な最適無線伝送路選択手段を備える無線端末装置であることを特徴とする。

【0014】本発明によれば、接続先の無線通信システムの切り替えを、利用者の状態等に応じて、自動的に切り換えることが可能となる。このため、利用者によるわずらわしい動作は軽減し、アプリケーションの動作を適切に行うことができる。

【0015】

【発明の実施の形態】以下図面を参照して、本発明の実施の形態を説明する。以下の図面の記載において、同一または類似の部分には同一または類似の符号を付している。以下では、まず、本発明に係る無線端末装置について説明し、次に、本発明に係る無線通信システムおよび無線通信方法について 6 つの実施の形態を用いて説明する。

【0016】（本発明に係る無線端末装置）図 1 は、本発明に係る無線端末装置を含む無線通信システムを示す概略構成図である。この無線通信システムは、構内通信を行なう第 1 の通信網 10 と、公衆接続を行なう第 2 および第 3 の通信網 12、14 と、第 1、第 2 および第 3 の通信網 10、12、14 それぞれに接続された第 1、第 2 および第 3 の無線基地局 16、18、20 と、第 1、第 2 および第 3 の無線基地局 16、18、20 を介して、それぞれに対応する通信網 10、12、14 に無線接続可能な無線端末装置 22 と、から構成されている。第 1 の通信網 10 と第 2 の通信網 12 との間には、インターフェース 24 が接続され、第 2 の通信網 12 と第 3 の通信網 14 との間には、インターフェース 26 が接続されている。

【0017】本発明に係る無線端末装置 22 は、第 1、第 2 および第 3 の無線基地局 16、18、20 それぞれに対して無線通信を実現する。無線端末装置 22 は、第 1、第 2 および第 3 の基地局 16、18、20 それぞれと通信可能な無線インターフェースを少なくとも有している。通常、各基地局 16、18、20 それぞれの通信可能エリアのすべてが重なっているわけではない。そのため、無線端末装置 22 は、通信を確立できる無線基地局を第 1、第 2 および第 3 の無線基地局 16、18、20 のうちから選択し、アプリケーションの要求する通信性能の中から最も適切な通信路を選択する。図 1 では、無線基地局 16 は、Bluetooth や、無線 LAN、ホーム RF のように近距離の構内通信を実現する無線通信の基地局、無線基地局 18 は、PDC のような公衆用の移動通信網の基地局であり、自動車の移動速度の

50

7

ような高速な移動に対しても安定した通信を行うことができる無線通信の基地局、無線基地局109は、PHSや高速移動アクセスのような歩行速度程度の移動を提供する公衆用の無線通信の基地局である。

【0018】次に、図1に示した無線端末装置22のレイヤ構成について説明する。図2は、図1の無線端末装置22のレイヤ構成の第1の例を示す図である。この第1の例は、無線部に2.4GHz帯を用いた場合における無線装置の選択方法に関する例である。この第1の例では、Bluetooth、ホームRF、IEEE802.11(IEEE802.11bも含む。以下、同様)それぞれに対応する、物理層およびMAC層がそれぞれ独立に構成されている。無線切り替え制御ミドルウェア(RLC)は、無線装置の切り替えを行なうことで、アプリケーション(AP)において要求する通信品質を具現し、さらに、QoS管理部は、ユーザアプリケーションの要求する品質を確保できるように、再送制御およびフロー制御をLLC層またはTCP層に対して行う。

【0019】図3は、図1の無線端末装置22のレイヤ構成の第2の例を示す図である。この第2の例では、ユーザアプリケーションのQoS要求条件を管理するアプリケーション管理部と、無線管理制御ミドルウェア(RLC)とを有している。さらに、物理層およびMAC層は、ソフトウェア無線機のように同一のハードウェアを用いて柔軟に接続する無線システム切り替え可能なものである。アプリケーション管理部から要求されるQoS情報に基づき、無線管理制御ミドルウェア(RLC)は、ソフトウェア無線機を制御し、要求されるQoS情報を満たすようにソフトウェア無線機の制御を行なう。この場合に接続される無線機は、たとえば、Bluetooth、ホームRF、IEEE802.11が考えられる。

【0020】図4は、図1の無線端末装置22のレイヤ構成の第3の例を示す図である。この第3の例では、物理層として、Bluetooth、ホームRF、IEEE802.11などのシステムごとにデータリンク、IP、TCP/UDPなどを有している。さらに、ユーザアプリケーションからの通信品質要求を行なうアプリケーション管理部と、電池・センサなどにより端末または利用者の状態を監視する装置と、システムごとに設けられたインターフェースを切り替えるインターフェース切り替え制御ミドルウェアと、を有している。アプリケーション管理部は、ユーザアプリケーションの要求する通信品質、電池・センサ等から得られる端末または利用者の状態を示す情報に基づいて、あらかじめ定められたアルゴリズムにしたがって通信ミドルウェアの接続するシステムインターフェースを切り替えることにより、適切な無線装置を選択する。

【0021】図5は、図1の無線端末装置22のレイヤ

8

構成の第4の例を示す図である。この第4の例は、たとえば、5GHz帯を用いた場合の無線装置の選択方法に関する例である。この第4の例は、アプリケーション管理制御部、無線管理制御ミドルウェア(RLC)などから成るが、MAC層は、ソフトウェアによりシステム間の差異を実現するものである。さらに、物理層は、5.2GHz帯用および5.3GHz帯用がそれぞれ設けられている。アプリケーション管理制御部は、アプリケーションの要求する通信品質を無線管理制御ミドルウェア部(RLC)に伝送し、無線管理制御ミドルウェア部において接続する無線装置を決定し、MAC層を接続するシステムに対応させると共に、必要な物理層に接続して所望の無線システムを実現する。

【0022】(第1の実施の形態)次に、本発明の第1の実施の形態について説明する。図6は、本発明の第1の実施の形態に係る無線通信システムを示す概略構成図である。図6では、無線端末装置22の通信相手として、第1の通信網10には、メールなどの個別蓄積情報により構成される情報サーバ30、第2の通信網12には広告情報により構成される情報サーバ32、第3の通信網14には、動画、静止画を含むマルチメディア情報より構成される情報サーバ34がそれぞれ接続されている。無線端末装置11は、これらの情報サーバ30、32、34のうちから通信先を選択することになる。

【0023】次に、本発明の第1の実施の形態の動作について説明する。まず、無線端末装置22は、無線端末装置22のバッテリー残量、表示画面の性能、利用者からの要求内容、アプリケーションが要求する通信品質、アプリケーションのバージョン情報などに基づいて、利用者が要求するコンテンツを含む情報サーバ30、32、34を選択し、その選択の結果から接続する通信網10、12、14を決定する。たとえば、動画を含むマルチメディア情報を情報サーバ34から受信する場合を考える。無線端末装置22のバッテリー残量が十分あり、無線端末装置22の表示装置が高精細の動画を表示できる場合には、無線端末装置22の通信ミドルウェアは、第3の通信網14を介して、情報サーバ34との通信を実行する。情報サーバ34から提供される情報は、動画を主体とする大容量情報であり、これを運ぶために、第3の無線伝送路を介して、無線基地局20へ無線端末装置22は接続を行う。さらに、無線端末装置22のアプリケーションが、情報サーバ30からメール転送を同時に要求する場合、あるいは、情報サーバ32から広告情報を受信することにより通信料金を下げる効果が期待される場合などは、必要に応じて、インターフェース24、26を介して情報サーバ30、32から情報を受信する。

【0024】また、第3の無線伝送路よりも伝送速度の低い第2の無線伝送路の利用で十分な場合には、無線端末装置22の通信ミドルウェアは、通信に必要なコスト

や、消費電力の面から有利である、第2の無線伝送路および第2の通信網12を介して、情報サーバ34との通信を行う。このような場合は、たとえば、バッテリー残量が少ない場合、アプリケーションの要求する情報伝送内容が、第3の通信網14より少ない伝送速度の場合、あるいは、高速に移動する場合、第3の無線基地局20のエリア外であるなどの理由により発生する。

【0025】さらに、構内通信による第1の通信網10の無線基地局16に接続可能な場合は、無線端末装置22の通信ミドルウェアは、第1の無線伝送路および第1の通信網10を介して、情報サーバ30、32、34との通信を行う。構内通信では一般的に通信料金が通信の都度発生するわけではないので、これにより安価な通信を実現することが可能となる。

【0026】また、一般に伝送速度が高速であるほうが同一の伝送方式、伝送品質では消費電力が大きくなるので、これらの選択は、たとえば、バッテリー動作による無線端末装置22の動作時間の延長に有効に作用する。また、通信構内無線通信では通信距離が公衆無線通信より短いため、送信出力を小さくして通信を行うことにより、同様にバッテリー動作による端末の動作時間を延長することができる。

【0027】ここで、上記の図1および図6に示した無線端末装置22の具体的な構成について説明する。図7は、無線端末装置22の構成を示すブロック図である。この無線端末装置22は、通信制御部2201と、無線受信部2202a、2202b、2202cと、バッテリー装置2203と、加速度センサ2204と、位置センサ2205と、端末状態判定部2206と、表示装置2207と、入力装置2208と、ユーザアプリケーション2209と、無線送信部2210a、2210b、2210cと、から構成されている。

【0028】次に、図8を用いて、図7の無線端末装置22の受信動作について説明する。図8は、図7の無線端末装置22の受信動作の処理手順を示すフローチャートである。まず最初、通信制御部2201は、無線受信部2202a、2202b、2202cから無線受信情報を読み込み、その無線受信情報から使用可能な無線機を判断する(ステップS101)。続いて、表示装置2207、入力装置2208、ユーザアプリケーション2209それぞれの状態を読み込み、使用可能な無線機の中から実際に使用する無線機の候補を決定する(ステップS102)。通常、表示装置2207、入力装置2208およびユーザアプリケーション2209それぞれから出力される表示装置状態情報、入力装置状態情報および要求QoS情報は、図示しないメモリ等の格納装置に一旦格納された後、通信制御部2201に読み込まれることになる。

【0029】次に、端末状態判定部2206は、加速度センサ2204および位置センサ2205から加速度情

報および位置情報を取得し、無線端末装置22が動作可能な状態であるか否かを判定する(ステップS103)。通常、その端末状態判定情報は、一旦、図示しないメモリ等の格納装置に記録される。そして、通信制御部2201は、その格納装置内に格納された端末状態判定情報に基づいて、無線端末装置22の動作状態、つまり、無線端末装置22の利用者の動作状態を判断し、無線端末装置22に要求される受信性能を判断する(ステップS104)。たとえば、利用者が画面を見ていない状態では、リアルタイム画像の受信は不要である。この場合、伝送速度を落として画像データを受信すれば良い。

【0030】次に、通信制御部2201は、ステップS104の判定結果に基づいて、使用する無線機の絞り込みを実行する(ステップS105)。無線機の使用候補は、1つのみならず、複数であっても構わない。ただし、複数ある場合、あらかじめ定められたアルゴリズム等により優先順位付けされるものとする。そして、使用候補である無線機の中から一つを選択し(ステップS106)、通信制御部2201は、その選択された候補によって通信可能であるか否かを、無線受信部2202a、2202b、2202cからの無線受信情報を参照することで、判断する(ステップS107)。そして、その候補が条件を満足しない場合(ステップS107NO)、次候補がさらに有れば(ステップS108YES)あれば、上記のステップS106に戻る。一方、次候補が無ければ(ステップS108NO)、データ受信を中止し(ステップS109)、受信動作はここで終了する。

【0031】ステップS107で選択された無線機が条件を満足すれば(ステップS107YES)、使用する無線機として決定する(ステップS110)。そして、次候補がさらに有れば(ステップS111YES)、上記のステップS106に戻る。一方、もう次候補が無ければ(ステップS111NO)、通信制御部2201は、無線受信部2202a、2202b、2202cに受信機制御信号を送信し、受信に最適な無線機を選択し(ステップS112)、データ受信を開始し(ステップS113)、無線端末装置22の受信動作は終了する。

【0032】次に、図9を用いて、図7の無線端末装置22の送信動作について説明する。図9は、図7の無線端末装置22の送信動作の処理手順を示すフローチャートである。まず最初、通信制御部2201は、送信すべきデータが存在するか否かを確認する(ステップS201)。そして、送信データが無ければ(ステップS202NO)、タイマ等の手段により送信データ待ちを継続するか否かを判断し、継続する場合には(ステップS213YES)、ステップS201に戻る。継続しない場合には(ステップS213NO)、直ちにデータ送信を中止し(ステップS210)、無線端末装置22の送信

動作は終了する。

【0033】一方、送信データが有れば（ステップS202YES）、通信制御部2201は、端末状態判定情報を読み込み、無線端末装置22が動作可能状態であるか否かを判断する（ステップS203）。また、このステップS203で、バッテリー2203からバッテリー残量情報を取得しても良い。続いて、無線端末装置22が送信動作可能な状態であるか否かが判断される（ステップS204）。たとえば、ユーザアプリケーション2209が利用者によるカメラ画像のリアルタイム送信を望んだ場合であっても、上記のステップS203で利用者が歩行状態にあると判断された場合には、正しい画像を送信できないと判断し（ステップS204NO）、画像信号に必要な広帯域通信を行わない（ステップS210）、等の動作が考えられる。また、バッテリー残量情報からバッテリーの残量が少ないと判断された場合にも、送信動作不可能であると判断しても良い。そして、ここで、送信動作は終了する。

【0034】一方、無線端末装置22が送信動作可能な状態であると判定される場合には（ステップS204YES）、通信制御部2201は、無線受信情報を読み込んで（ステップS205）、無線機の選択候補を決定する（ステップS206）。ここで、無線受信情報に基づいて無線機を選択候補を決定するのは、通常、送信と受信は、同一の無線基地局に対して対で行われるため、無線基地局からの報知情報を受信できない無線伝送路を使つての送信はできないと考えられるからである。しかし、たとえば、送信と受信との間で異なった無線機を利用するハイブリッド無線通信システムの場合には、受信状態の確認動作であるステップS205は省略することも可能である。

【0035】そして、選択候補である無線機の中から一つを選択し（ステップS207）、その無線機が送信可能であるか否かを判断し、送信が不可能である場合には（ステップS208NO）、次候補がさらに有れば（ステップS209YES）、上記のステップS207に戻る。一方、次候補が無ければ（ステップS209NO）、データ送信を中止し（ステップS210）、送信動作はここで終了する。なお、上記のステップS208の判断は、たとえば、無線基地局から送信される報知情報を対となる受信機が受信できるかどうかで判断すれば良い。

【0036】一方、送信可能である場合には（ステップS208YES）、その無線機の使用を決定し（ステップS211）、データ送信を開始し（ステップS212）、無線端末装置22の送信動作を終了する。なお、送信のみならず受信も同時に行ってもよい。

【0037】ここで、上記の図8の受信動作および図9の送信動作における、選択された無線機の優先順位付けは、たとえば、次のように行えば良い。図10は、選択

された無線機の優先順位付けの方法を説明するための図である。図10（a）の例は、通信データ量をMとして、通信路1の伝送速度、時間単価がそれぞれa、A、通信路2の伝送速度、時間単価がそれぞれb、B、通信路3の伝送速度、時間単価がそれぞれc、Cである場合である、この場合、各通信路1、2、3それぞれの通信コストは、 $(A/a)M$ 、 $(B/b)M$ 、 $(C/c)M$ となる。したがって、通信コストが通信路2、1、3の順に安いものであれば、その安い順に通信路の優位順位付けを行えば良い。

【0038】図10（b）の例は、通信路1は時間に応じて通信料金が決定される時間課金方式、通信路2はパケット数に応じて通信料金が決定されるパケット課金方式、通信路3は定額料金である場合である。ここで、通信路2の通信料金はパケットあたりp、平均パケット長を1であるとする、データ送信のために必要な限界コストは、通信路1、2、3それぞれにおいて、 $(A/a)M$ 、 $(M/1)p$ 、0と計算できる。この場合、通信コストが通信路3、2、1の順に安いものであれば、その順に通信路選択の優位順位を付ければ良い。

【0039】このような計算のテーブルを端末内部に持つことにより、容易にコストの安い無線通信路を選択することが可能となる。

【0040】また、このような通信路の優先順位付けは、上記の例のような通信コストだけでなく、その他の要因を用いて順位付けすることもできる。たとえば、携帯端末の場合、バッテリー残量が多いときはコストを優先して通信路を決定し、バッテリー残量が少なくなってきた場合には、より低消費電力の通信路を優先して通信路を決定すれば良い。低消費電力の通信路決定方法としては、伝送速度だけでなく、基地局からの受信電界強度情報を得ることで、基地局への必要な送信電力制御を行ない、もっとも基地局が近く、かつ、消費電力の少ない無線通信路を選択することもできる。

【0041】さら、上記の例のようなコストによる選択でなく、コンテンツ内容に応じて基地局を選択することも可能である。たとえば、図10（c）の例では、データ量がある程度の範囲に収まっていると予想される定型コンテンツの場合には、課金が定額制の通信路1を利用し、データ量の範囲が定まらないリアルタイム画像伝送などの従量型コンテンツの場合には、課金が従量制の通信路のうち通信料金が安いエリアが狭い通信路3を優先して選択し、次いで通信料金は通信路3より割高だが通信エリアの広い通信路2をサーチして選択する。

【0042】このような選択アルゴリズムを通信制御部に備えることにより、端末の消費電力を抑制し、端末の小型化、通信時間の長大化、通信料金の低額化を実現することができる。

【0043】（第2の実施の形態）次に、本発明の第2の実施の形態について説明する。この第2の実施の形態

13

は、上記の第1の実施の形態に係る無線通信システムの具体的な適用例を示すものである。図11は、本発明の第2の実施の形態に係る通信システムの概略構成図である。

【0044】図11(a)において、この第2の実施の形態の通信システムは、第1の通信網36と、第2の通信網38と、第1の通信網36に接続し、高速伝送可能な第1の無線基地局（たとえば、CDMA無線基地局）40と、第2の通信網38に接続し、第1の無線基地局40よりも低速な伝送を行う第2の無線基地局（たとえば、PHSの無線基地局）42と、第1および第2の無線基地局40、42との間で無線通信する無線端末装置44と、から構成されている。無線端末装置44は、アンテナ4401と、表示装置4402と、表示装置4402と平行に設けられた加速度センサ4403と、を備えている。そして、無線端末装置44は、第1の無線基地局40との間で高速無線伝送路46を形成し、第2の無線基地局42との間で低速無線伝送路48を形成する。

【0045】図11(a)は、無線端末装置44の利用者が、無線端末装置44の表示装置4402に表示されている画像をまきに見ている状態を示している。この場合、無線端末装置44に備え付けられた加速度センサ4403は、無線端末装置44が重力方向を検知するような方向に位置することになる。それにより、加速度センサ4403は、無線端末装置44の表示装置4402が上向き方向にあると検知することができる。というのは、通常、画面表示のある携帯端末は、利用者の目線より下に位置して、その画面が視聴されることになる。したがって、端末が上向き方向であることを検知すれば、利用者がその画面を見ていると判断することが可能となる。そして、利用者が、たとえば、リアルタイム画像を視聴している場合であれば、無線端末装置44は、第1の無線基地局40との間で高速無線伝送路46を形成し、画面を見ている状態においては利用者にストレスなくリアルタイム画像を表示することを可能とする。

【0046】一方、図11(b)に示すように、無線端末装置44の表示装置4402が、縦または裏向きに置かれるような場合においては、通常、利用者は画面を見ていないと考えられる。この場合、リアルタイムに画像を受信することは不要である。そこで、加速度センサ4403によって無線端末装置44が縦または裏向きに置かれていると検知された場合、利用者データの通信などは、低速な無線通信路48を通じて第2の無線基地局42に接続する。これにより、電力消費の大きな高速無線通信を行わずにデータ通信を実現できる。このため、無線端末装置44のバッテリー仕様比を小さくすることができる。さらに、図11(b)の場合、表示装置4402の表示をオフ状態にすることにより、さらなる消費電力の削減も可能である。

14

【0047】図11の加速度センサ4403としては、たとえば、2次元型加速度センサであるアナログデバイス社製ADXL202JCを用いれば良い。この加速度センサでは、2軸の合成加速度により、端末の重力方向に対する位置関係を検知することが可能である。また、端末が加減速状態にある場合には正確な重力方向を検知できないが、さらにこの加速度センサを3次元目の方向に向けてもう1台増設することにより、3次元での重力方向をより正確に把握することが可能である。

【0048】本発明の第3の実施の形態において、高速無線伝送路46は、第1の無線基地局40から無線端末装置44への下りリンクのみに使い、上りリンクは低速無線通信路48を使用するようにしても良い。この場合、より消費電力を小さくし、かつ、無線端末装置44の部品数の低減化によって端末価格を安くできる。

【0049】（第3の実施の形態）次に、本発明の第3の実施の形態について説明する。この第3の実施の形態も、上記の第2の実施の形態と同様、上記の第1の実施の形態に係る無線通信システムの具体的な適用例を示すものである。図12は、本発明の第3の実施の形態に係る通信システムの概略構成図である。

【0050】図12において、無線端末装置50は、家屋52内で、家屋52内に設置された家庭用の第1の無線基地局54と、家屋52の外に設置された公衆用の第2の無線基地局56の電波を少なくとも受信することができるものとする。家屋52内の無線端末装置50は、チャンネル切替によって、第1の無線基地局54と第2の無線基地局56のうちのいずれにも接続可能であるが、第1の無線基地局54は、その報知チャンネルの一部において家屋52内の家庭用無線基地局である旨のIDを報知しており、第2の無線基地局56は、同じくその報知チャンネルの一部において公衆用の無線基地局である旨のIDを報知しているものとする。

【0051】この場合、無線端末装置50は、第1の無線基地局54への接続を優先することにより、安定した品質の通信を行うことができ、さらに、家屋52の壁によって電波が減衰するために、外部への電波干渉を減少させて接続することが可能となる。

【0052】また、無線端末装置50が家屋52の内から外へ移動した場合、同一の無線周波数を用いているので、第2の無線基地局56へ接続する場合においても、同一の送受信回路を用いて接続でき、端末の小型化とコストを減少させることが可能となる。

【0053】家屋52の内側にいるか外側にいるかの判定は、第1の無線基地局54の報知情報の受信電界強度を測定し、第1の無線基地局54の受信電界強度が、所定のしきい値を超える場合には、第1の無線基地局54に接続することにより可能である。また、別の方法として周囲の照度を用いる方法や、GPS（測位衛星）を用いることにより、端末の位置情報と地図情報の参照から



15

家屋内外を判定することも可能である。

【0054】（第4の実施の形態）次に、本発明の第4の実施の形態について説明する。図13は、本発明の第4の実施の形態に係る通信システムの概略構成図である。図13は、デジタルカメラ装置62によって撮影された画像を、通信網72に接続されたサーバ装置74に、間接的に転送する場合を示している。

【0055】まず、図13(a)では、デジタルカメラ装置62は、美術館、ホール等の建築物66の内部に位置している。このため、デジタルカメラ装置62に内蔵された無線通信機は、通信網72の無線基地局68の通信エリア70の圏外にあり、直接無線基地局68と接続することはできない。このような場合に、無線端末装置64は、デジタルカメラ装置62内の画像を一旦受信し、その内部に蓄積する。この画像の受け渡しは、無線基地局68用の無線システムとは異なっていて良く、たとえば、Bluetoothによってデジタルカメラ装置62と無線端末装置64との間を一時的に接続すれば良い。無線端末装置64は、たとえば、腕時計のような形状により、常に利用者の体の外部と接している。

【0056】次に、図13(b)に示すように、無線端末装置64の利用者は、建築物66から外に出て、無線基地局68の通信エリア70内に移動する。この際、デジタルカメラ装置62は金属製の鞆76の中に入れて運ばれるとする。この場合、デジタルカメラ装置62は金属製の鞆76により生じる電波減衰により、無線基地局68に接続することができない。しかし、無線端末装置64は腕時計等体の外部に見える形であるため、無線基地局68と接続し、デジタルカメラ装置62からの蓄積データを通信網72を介してサーバ装置74に送信できる。サーバ装置74に代えて、別の通信端末装置に送信してももちろん構わない。

【0057】本発明の第5の実施の形態によれば、デジタルカメラ装置62が無線基地局68との接続に使用できる接続装置を持たない場合、あるいは、接続装置があったとしても直接伝送することができない状況であっても、無線端末装置64を経由することで、無線基地局68に非同期な無線データ伝送を行うことが可能となる。

【0058】（第5の実施の形態）次に、本発明の第5の実施の形態について説明する。図14は、本発明の第5の実施の形態に係る通信システムの概略構成図である。図14において、第1の無線端末装置78は、たとえば、PDA(Personal Digital Assistant)のような、表示装置を備えた無線端末装置である。また、第2の無線端末装置80は、第1の無線端末装置78と無線基地局82の両方に接続可能であり、たとえば腕時計のように、常に外部にさらされているものとする。

【0059】図14(a)は、第1および第2の無線端末装置78、80に利用者が、駅構内の自動改札装置8

16

4を通過する場合を示している。ここで、情報サーバ88から第1の無線端末装置78宛ての電子メール等のデータが存在するが、第1の無線端末装置78は鞆に入っており、電波減衰により無線基地局82と通信できないとする。これは、たとえば、5GHz帯のような高周波数の場合には、見通しのできない状況においては、通信が困難になるからである。このような場合には、接続の容易な第2の無線端末装置80によって、一旦、第1の無線端末装置78宛てのデータを受信し、第1の無線端末装置80の記憶装置に蓄積する。

【0060】そして、図14(b)に示すように、利用者は、鉄道車両90内で、第2の無線端末装置80内に一旦蓄積されたデータを第1の無線端末装置78に転送し、第1の無線端末装置78で動画などの表示を行うことが可能である。

【0061】（第6の実施の形態）次に、本発明の第6の実施の形態について説明する。図15は、本発明の第6の実施の形態に係る通信システムを説明するための図であり、(a)は、その概略構成図、(b)は、(a)のゲートウェイサーバの構成を示す図である。

【0062】図15(a)において、たとえば、無線端末装置92を携帯する利用者が、事故によって意識を失い、病院を呼び出すことができないとする。この場合、無線端末装置92は、利用者が危険な状態であることを検知し、その情報を自動的に必要な場所に通報し、利用者の救助の助けを行う。

【0063】具体的には、無線端末装置92は、利用者の健康状態を監視し、危険な状態を検知した場合は、無線基地局94に接続し、ゲートウェイサーバ96に緊急信号を通知する。これは、たとえば、危険を通知する種類のメッセージIDを利用するが、119番のような固定番号だけでなく、利用者の危険状態に応じた特別な番号を通知することができる。

【0064】図15(b)に示すように、ゲートウェイサーバ96の内部では、通信制御部98内のテーブル100を参照し、たとえば、利用者のかかりつけの医者102の呼出し番号により、端末106に緊急呼び出しを表示させる。あるいは、消防署や救急センター108の呼出し番号により、通信端末装置110に緊急呼び出しを表示させて救急車の出動をすることができる。この場合のテーブル100には呼び出しの順番に並んでいるが、危険の状態によって呼び出し先を変更するように設定できる。

【0065】また、ゲートウェイサーバ96は、親戚など関係者112の端末114を無線基地局116を介して呼び出すことにより、危険を関係者112に通知させることも可能である。さらに、ゲートウェイサーバ96からテーブル100により呼び出し先の切替を行なうのではなく、たとえばサービスプロバイダ118が通信終端装置104それぞれの呼び出しの機能を代行して行っ

てもよい。

【0066】図16は、本発明の第6の実施の形態の別の構成を示す図である。図16では、無線端末装置120が、その利用者が外出先で事故、病気などで倒れるなど危険であると検知した場合に、あらかじめ設定された緊急連絡先の呼び出し符号を無線基地局124を介して呼び出すことにより、病院126、消防署、緊急センター128それぞれの通信終端装置130を介して端末装置134に危険を通知する。消防署または緊急センター係員136または医療スタッフ138は、それぞれの端末134を見ることにより、利用者の危険を検知して救急車の出動等の手配を迅速に行う。それにより、利用者の救助を行うことが可能となる。また、無線端末装置120は、親戚など関係者140の家142のゲートウェイ装置144に緊急信号を通知することにより、構内無線基地局146を介して利用者端末装置148に緊急情報を表示させ、関係者140に利用者の危険を知らせることができる。

【0067】上記の図16において、利用者の位置情報は、たとえば、無線基地局124から報知される基地局IDを元に知ることができ、これを端末装置134、148に表示させることにより救助を迅速かつ正確に行うことが可能となる。また、無線端末装置120において呼び出し先のテーブルをもって検索するのではなく、サービスプロバイダ150が呼び出し先のテーブルを持っており、無線端末装置120は、サービスプロバイダ150に利用者の危険状態を通知することにより、サービスプロバイダ150が消防署または救急センター128、病院126または関係者140を呼び出すことも可能である。

【0068】図17は、上記の図15および図16の無線端末装置92、120の構成例を示すブロック図である。図17において、この無線端末装置は、赤外線センサ152と、カメラ装置154と、加速度センサ156と、脈波センサ158と、位置センサ160と、健康管理情報記憶部162と、画像処理部164と、ユーザ状態判定部166と、通信制御部168と、通信先リスト170と、通信処理部172と、無線受信部174と、無線送信部176と、を少なくとも備えている。

【0069】図17の無線端末装置では、赤外線センサ152の測定情報、あるいは、カメラ装置154の画像信号に基づいて、この無線端末装置の利用者の顔や眼、体の状態を画像処理部164によって処理し、その処理結果である画像処理信号をユーザ状態判定部166に送信する。さらに、ユーザ状態判定部166は、加速度センサ156からの加速度信号、脈波センサ158からの脈波情報、および、位置センサ160からの位置信号を入力し、利用者の体の状態を判定する。また、ユーザ状態判定部166は、必要に応じて、健康管理情報記憶部162に格納されている健康管理情報を参照し、利用者

の体の状態を監視する。

【0070】そして、ユーザ状態判定部166は、利用者の体の状態に異常、危険を検知した場合には、危険である旨を示すユーザ状態判定信号を通信制御部168に送信する。通信制御部168は、利用者の通信先のIDを格納する通信先リスト170から利用者のかかりつけの医者等の呼び出しIDを含む通信先リスト情報を読み出し、通信処理部172に通信制御信号を送信する。通信処理部172は、無線受信部174および無線送信部176それぞれに受信機制御信号、送信機制御信号を出力し、受信データおよび送信データの送受信を行う。

【0071】

【発明の効果】本発明によれば、接続先の無線通信システムの切り替えを、利用者の状態等に応じて、自動的に切り替えることが可能な無線端末装置を実現できる。このため、利用者による切り替えが不要となり、利用者はわずらわしい切り替え動作を行わなくて良いことになる。また、自動切り替えによって、無線端末装置のアプリケーションをより適切に動作させることが可能となる。

【図面の簡単な説明】

【図1】本発明に係る無線端末装置を含む無線通信システムを示す概略構成図である。

【図2】図1の無線端末装置22のレイヤ構成の第1の例を示す図である。

【図3】図1の無線端末装置22のレイヤ構成の第2の例を示す図である。

【図4】図1の無線端末装置22のレイヤ構成の第3の例を示す図である。

【図5】図1の無線端末装置22のレイヤ構成の第4の例を示す図である。

【図6】本発明の第1の実施の形態に係る無線通信システムを示す概略構成図である。

【図7】図6の無線端末装置22の構成を示すブロック図である。

【図8】図7の無線端末装置22の受信動作の処理手順を示すフローチャートである。

【図9】図7の無線端末装置22の送信動作の処理手順を示すフローチャートである。

【図10】無線機の優先順位付けの方法を説明するための図である。

【図11】本発明の第2の実施の形態に係る通信システムの概略構成図である。

【図12】本発明の第3の実施の形態に係る通信システムの概略構成図である。

【図13】本発明の第4の実施の形態に係る通信システムの概略構成図である。

【図14】本発明の第5の実施の形態に係る通信システムの概略構成図である。

【図15】本発明の第6の実施の形態に係る通信システ

19

ムを説明するための図である。

【図16】本発明の第6の実施の形態の別の構成を示す図である。

【図17】図15および図16の無線端末装置92, 120の構成例を示すブロック図である。

【図18】従来の無線通信システムの構成例を示す図である。

【図19】従来の無線通信システムの他の構成例を示す図である。

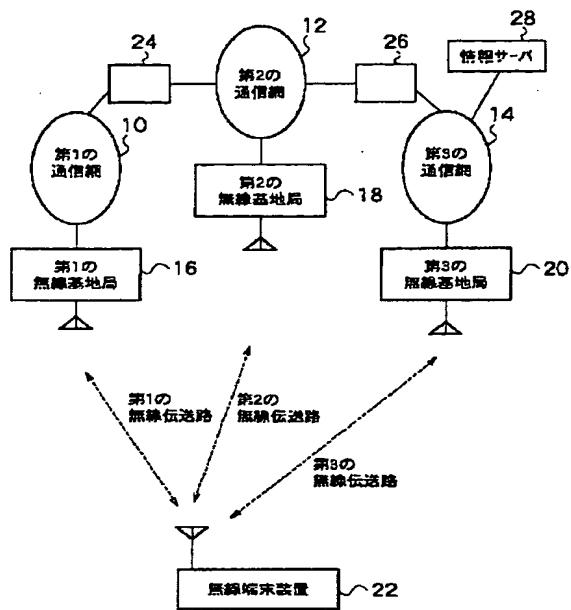
【符号の説明】

10, 12, 14, 36, 38, 58, 72, 86, 120, 150 通信網  
16, 18, 20, 40, 42, 54, 56, 68, 82, 94, 116, 124, 146, 1014, 1016, 1048 無線基地局  
22, 44, 50, 64, 78, 80, 92, 114, 122, 148, 1004 無線端末装置  
24, 26, 60, 96, 144, 1042 インターフェース(網間接続装置)  
28, 30, 32, 34, 74, 88, 1026, 1046 情報サーバ  
46 高速無線伝送路  
48 低速無線伝送路  
52, 142 家屋  
62 デジタルカメラ装置  
66 建築物  
70 通信エリア  
76 靴  
84 自動改札装置  
90 鉄道車両  
98 通信制御部  
100 テーブル  
102 医者  
104, 130 通信終端装置  
106, 110, 134 通信端末装置  
108, 128 消防署、救急センター  
112, 140 親戚などの関係者  
118 サービスプロバイダ  
126 病院  
136 消防署または救急センター係員

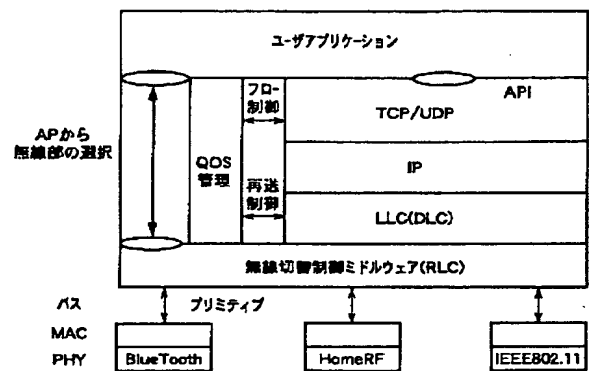
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138 医療スタッフ  
152 赤外線センサ  
154 カメラ装置  
156, 2204, 4403 加速度センサ  
158 脈波センサ  
160, 2205 位置センサ  
162 健康管理情報記憶部  
164 画像処理部  
166 ユーザ状態判定部  
168 通信制御部  
170 通信先リスト  
172 通信処理部  
174, 2202 無線受信部  
176, 2210 無線送信部  
1000 PHS網  
1002 PDC網  
1006 表示部  
1008 テンキー  
1010, 1012 無線アンテナ  
1018, 1052 アクセスサーバ  
1020, 1044 インターネット  
1022, 1024, 1054 通信先端末  
1028 PC装置  
1028a PCMCIAカードスロット  
1028b アイコン  
1028c マウスカーソル  
1030 PHSデータ通信カード  
1032 無線LANカード装置  
1034 PHS端末  
1036 親機  
1038 イーサネット  
1040 構内網  
1050 PHS網  
2201 通信制御部  
2203 バッテリー  
2206 端末状態判定部  
2207, 4402 表示装置  
2208 入力装置  
2209 ユーザアプリケーション  
4401 アンテナ

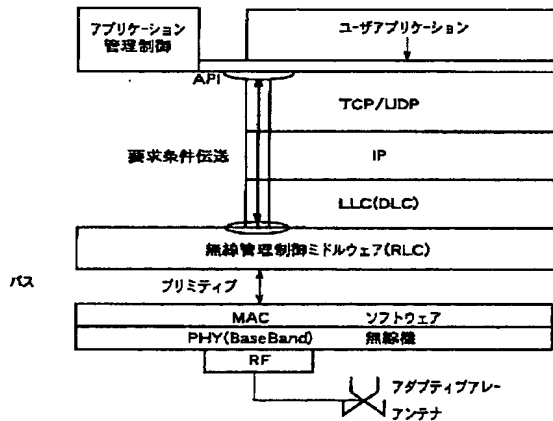
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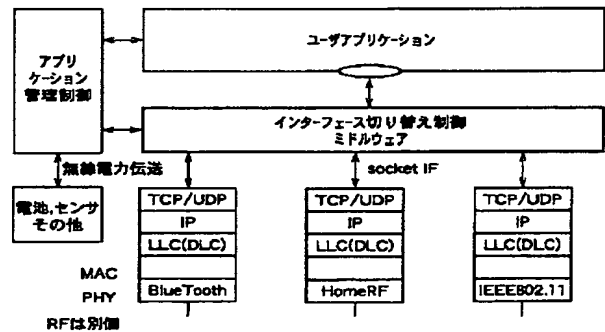
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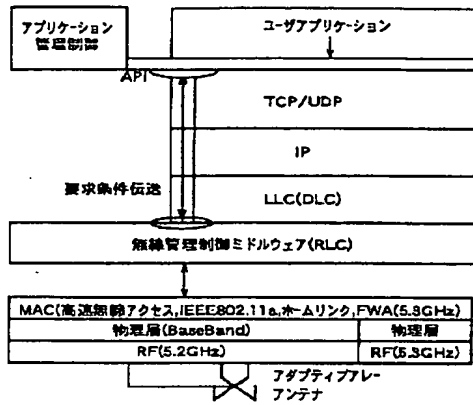
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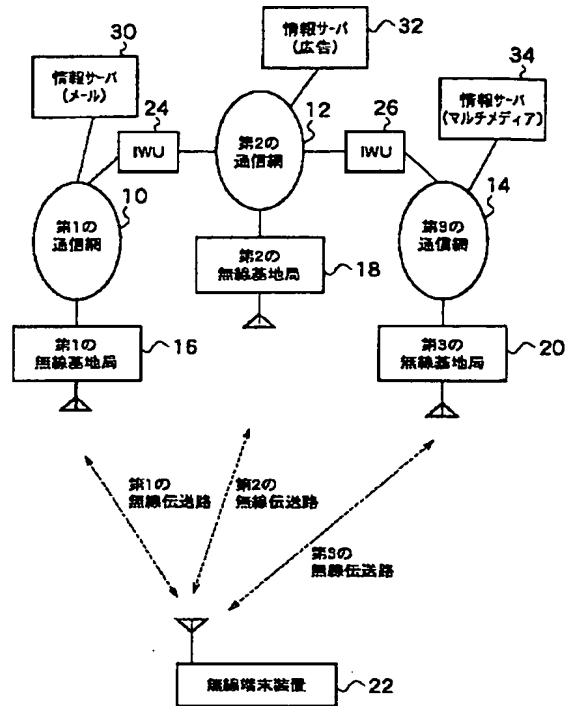
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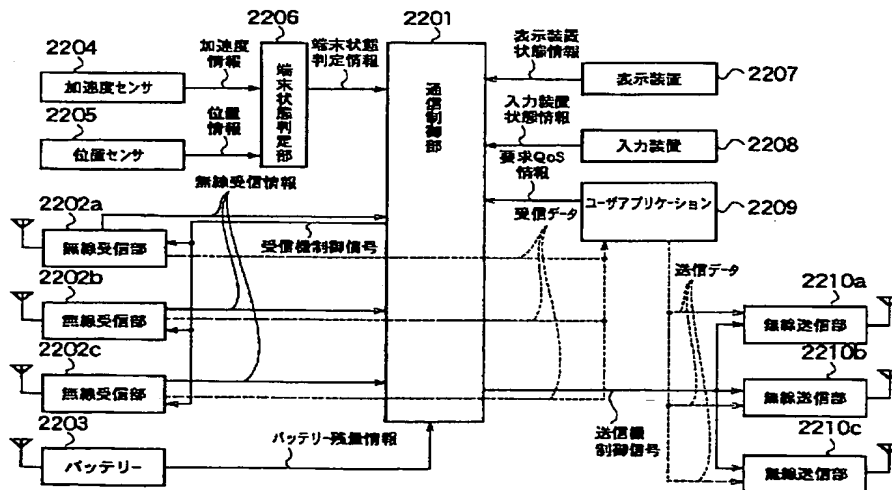
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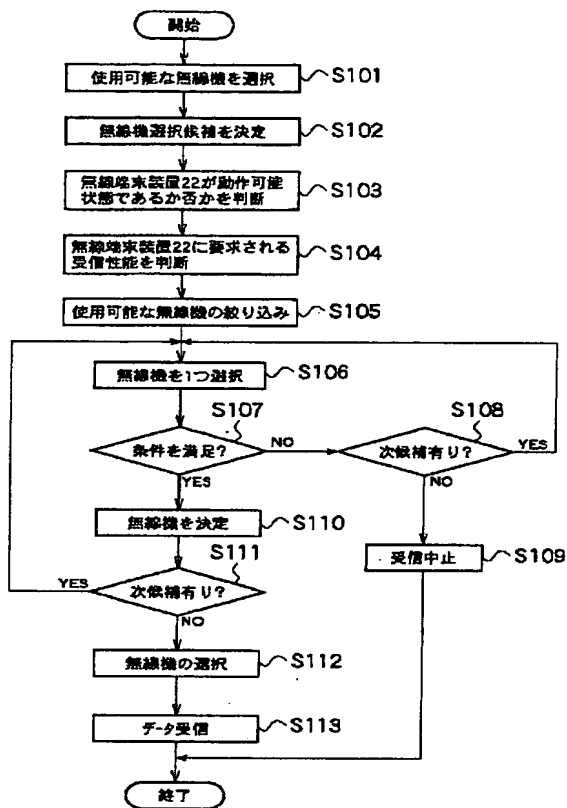
【図6】



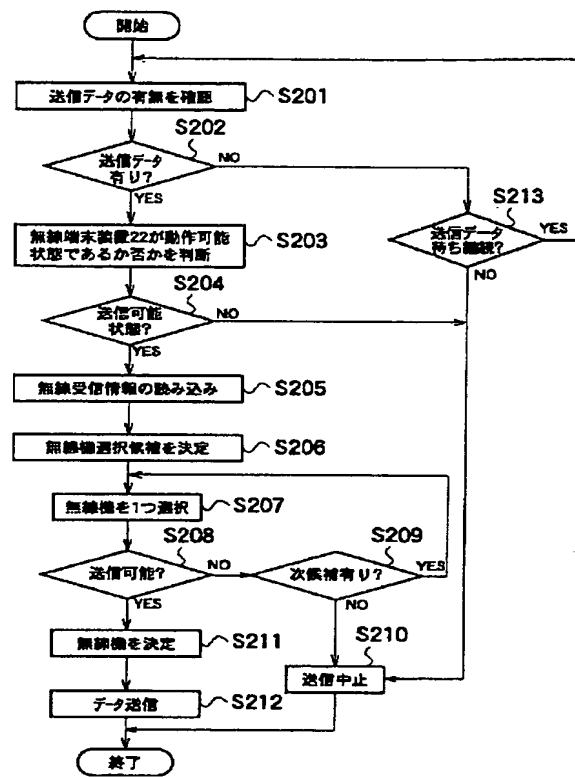
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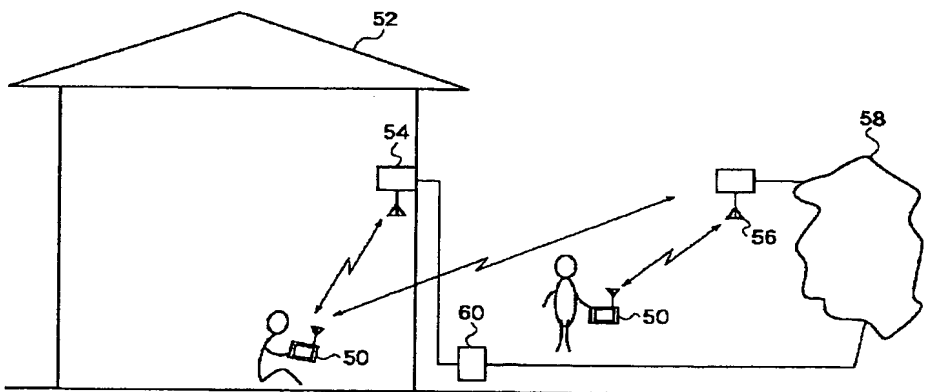
【図8】



【図9】



【図12】



【図10】

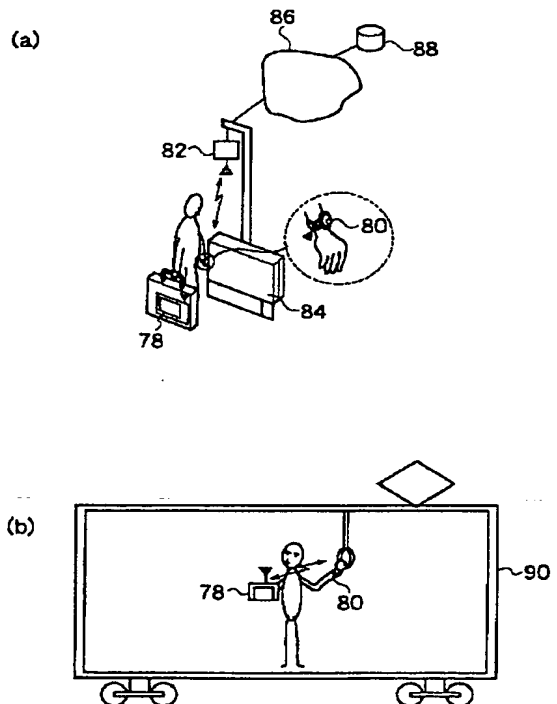
	伝送速度	通信時間	時間単価	コスト	優先順位
(a) 通信路1	a	M/a	A	$\frac{A}{a}M$	②
通信路2	b	M/b	B	$\frac{B}{b}M$	①
通信路3	c	M/c	C	$\frac{C}{c}M$	③

(a-b=cとも、キャリア選択)

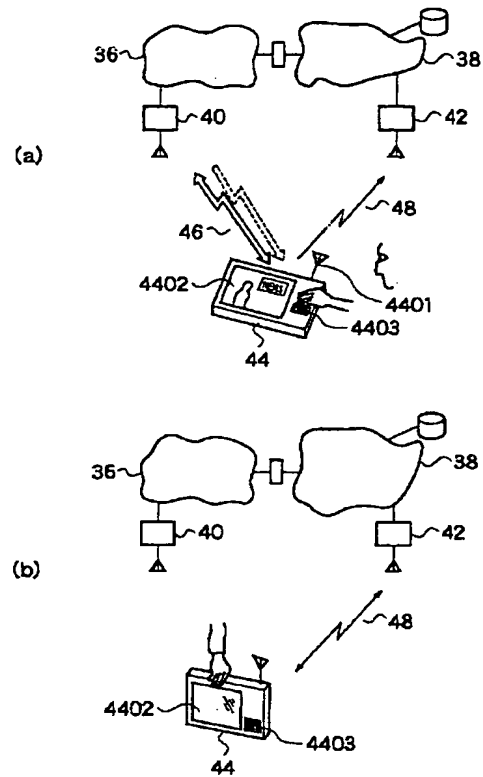
	通信料金体系	総経路コスト	優先順位
(b) 通信路1	時間課金	$\frac{A}{a}M$	②
通信路2	パケット課金	$\frac{M}{T}P$	②
通信路3	定額制	o	①

コンテンツ内容	選択通信路
定型コンテンツ	通信路1
従来型コンテンツ	通信路3→通信路2

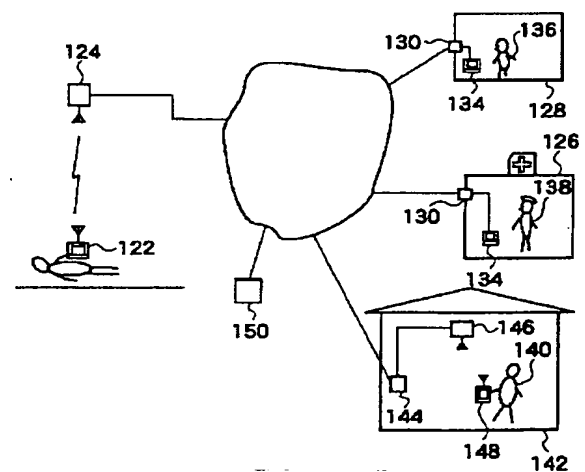
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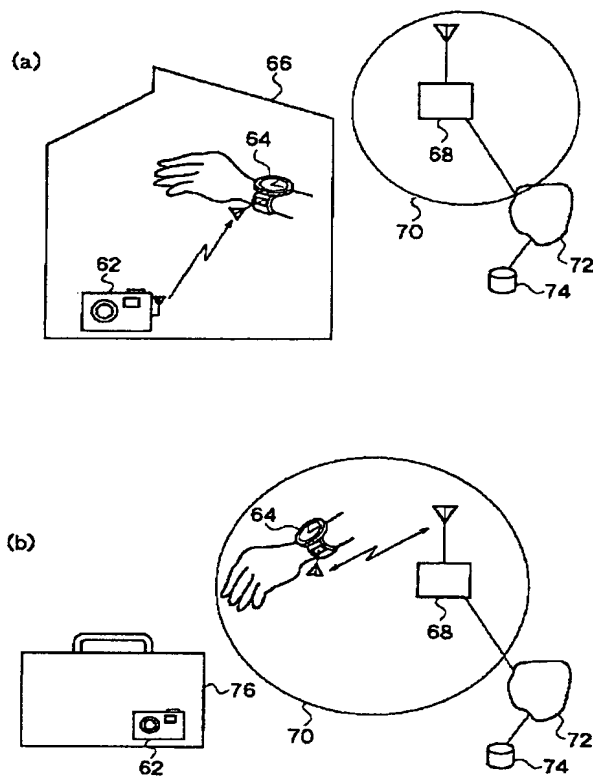
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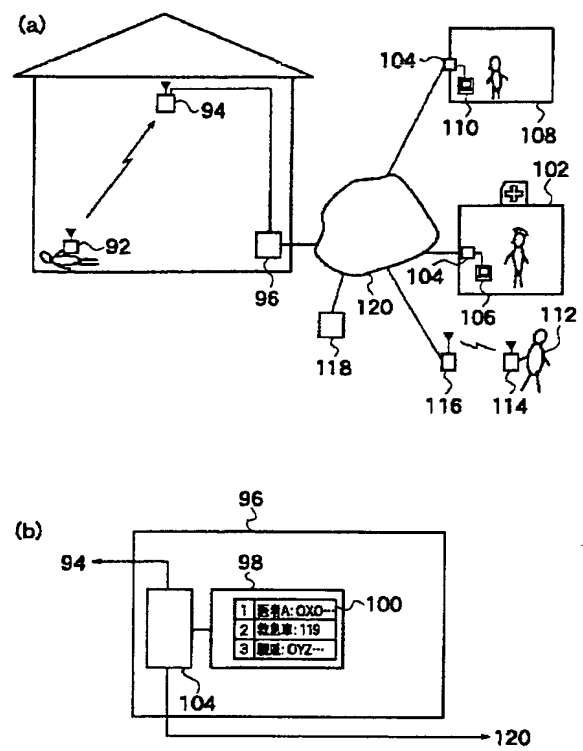
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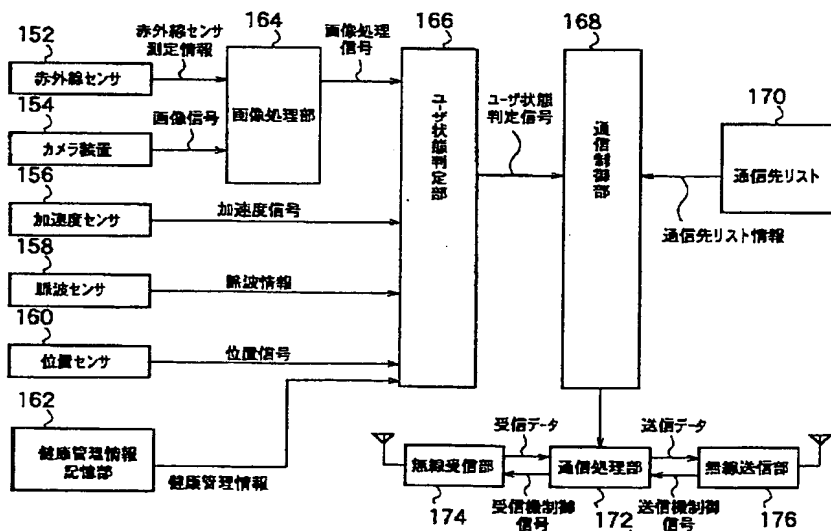
【図13】



【図15】

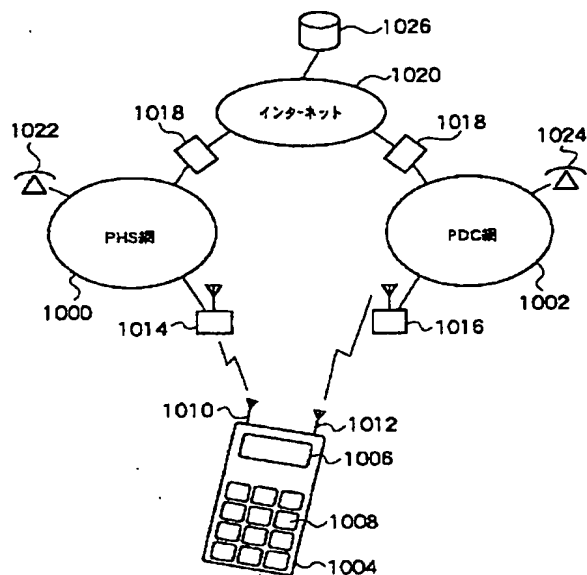


【図17】

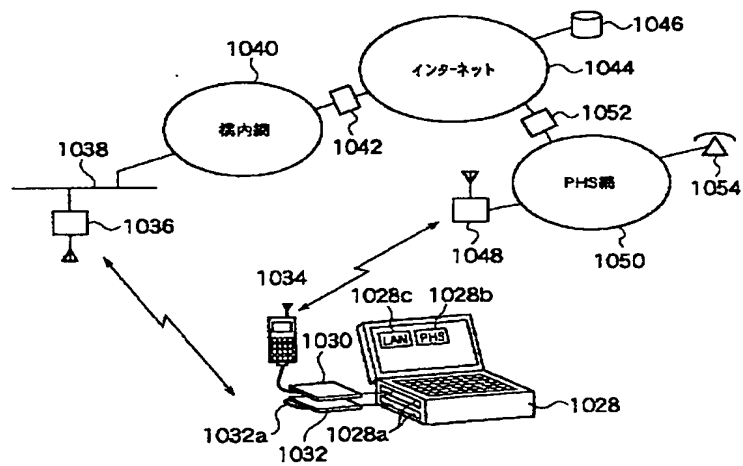




【図18】



【図19】



フロントページの続き

(51)Int. Cl.<sup>7</sup>

H 0 4 Q 7/24

7/26

7/30

識別記号

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FF02 FF22 KK03 MM04 MM17  
5K033 AA04 CB14 DA19  
5K034 AA11 AA19 EE03 JJ11  
5K067 AA21 BB03 BB04 BB21 CC04  
CC10 DD17 DD52 DD53 EE02  
EE03 EE10 EE16 EE32 EE37  
FF23 HH22 HH23 JJ52

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H04L 12/28  
H04L 29/04  
H04M 1/733  
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H04Q 7/30

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(71)Applicant : TOSHIBA CORP

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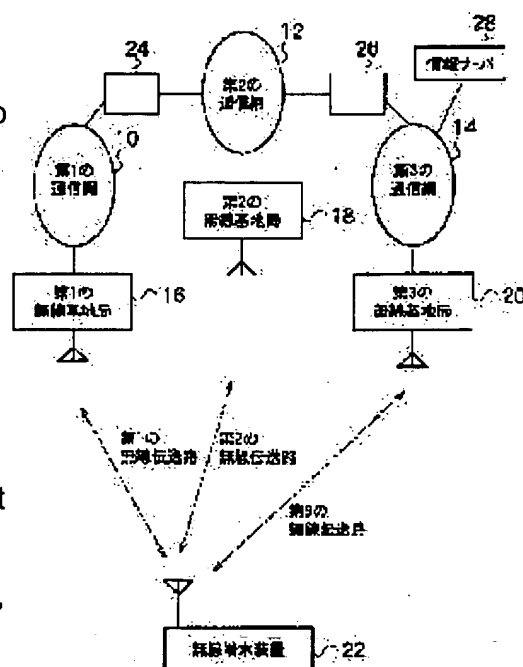
(72)Inventor : MORIYA OSAMU  
KUMAKI YOSHINARI

## (54) RADIO TERMINAL AND RADIO COMMUNICATION SYSTEM

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a radio terminal that automatically switches a connected destination radio communication system depending on the contents of an application, a communication state, a state of a user, and a surrounding environmental condition or the like.

SOLUTION: The radio terminal 22 that is connectable to each of communication networks 10, 12, 14 adopting different communication systems is provided with an optimum radio transmission channel selection means that can select an optimum radio transmission channel at any time on the basis of a prescribed radio transmission channel selection criterion among radio base stations 16, 18, 20 in the case of communication with any of the communication networks 10, 12, 14.



## LEGAL STATUS

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## CLAIMS

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[Claim(s)]

[Claim 1] The wireless terminal unit which is two or more radio communications systems of each and the connectable wireless terminal unit which adopt a different communication mode, and is characterized [ from ] by having an optimal radio-transmission way selection means selectable at any time for the optimal radio-transmission way based on a predetermined radio-transmission way selection criterion among two or more radio-transmission ways formed between the base transceiver stations of each of two or more of said radio communications systems in case it communicates between either of said two or more radio communications systems.

[Claim 2] The wireless terminal unit according to claim 1 characterized [ from ] by having further an optimal communication link place device-selector means selectable at any time for the optimal communication link place equipment based on predetermined communication link place device-selector criteria among two or more communication link place equipments connected to said each of two or more radio communications systems.

[Claim 3] The connection with said communication link place equipment is a wireless terminal unit according to claim 2 characterized by realizing through at least two of said two or more radio communications systems.

[Claim 4] The wireless terminal unit according to claim 3 characterized [ from ] by having further an optimal wireless routing means selectable at any time for the optimal radio-transmission way and optimal radio communications system which are used for connection with said communication link place equipment based on a predetermined connection path selection criterion said two or more radio-transmission ways and among radio communications systems.

[Claim 5] Said radio-transmission way selection criterion, communication link place device-selector criteria, and each connection path selection criterion The condition of said wireless terminal unit, the situation of the user of said wireless terminal unit, the contents of a communication link between said wireless terminal unit and said communication link place equipment, the costs which the communication link between the situation of said communication link place equipment, the condition of said radio-transmission way, and said wireless terminal unit and said communication link place equipment takes or power consumption, and \*\* -- the wireless terminal unit according to claim 4

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characterized by including at least one.

[Claim 6] The 1st communication network equipped with the 1st base transceiver station which forms the 1st radio-transmission way between the wireless terminal unit which has the display screen, and this wireless terminal unit, The 2nd communication network equipped with the 2nd base transceiver station which forms the 2nd radio-transmission way which has a low-speed transmission speed from said 1st radio-transmission way between said wireless terminal units is included. Said wireless terminal unit The detector which detects the gravity direction, and a means to judge the interrelation of the display direction of said display screen, and the look of the user of said wireless terminal unit based on the detection result from this detector, The radio communications system characterized by having a means to choose with any of said 1st and 2nd base transceiver stations it connects, based on the judgment result from this judgment means.

[Claim 7] It is the radio communications system according to claim 6 characterized by choosing connection with said 1st base transceiver station when judged with the display direction of said display screen and the look of said decision means of said user corresponding, and choosing connection with said 2nd base transceiver station when judged with the display direction of said display screen and said user's look not being in agreement.

[Claim 8]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a wireless terminal unit, a radio communications system, and the radio approach.

[0002]

[Description of the Prior Art] As for the conventional radio communications system, the communication link was performed using the separate frequency for every system. For this reason, a wireless terminal is connectable only with the radio communications system which is the terminal of a proper and corresponds at the radio communications system with which each is used. On the other hand, although the radio communication equipment of two or more classes was beforehand built in depending on the terminal and there was also a thing connectable with two or more radio communications systems, at once, it was connectable only with one system. Moreover, the switch of a radio communication equipment itself was performed by the hand control of the user of a wireless terminal.

[0003] In the radio communications system shown in drawing 18 , the wireless terminal unit 1004 connectable with the PHS network 1000 and the PDC network 1002 called a dual mode terminal is used two communication networks and here. The thing wireless terminal unit 1004 is equipped with a display 1006, a ten key 1008, the radio antenna 1010 for PHS network 100, the radio antenna 1012 for PDC network 1002, and \*. moreover, the PHS network 1000 and the PHS network 1002 -- respectively -- being alike -- base transceiver stations 1014 and 1016 are connected and the wireless terminal unit 1004 makes wireless connection through each base transceiver stations 1014 and 1016 at the PHS network 1000 and the PDC network 1002. The PHS network 100 and the PDC network 1002 are connected with the Internet 1020 which is a public network through the access server 2109 corresponding to each.

[0004] The wireless terminal unit 1004 can perform a voice message with the terminal 1022 of a communication link place which connects to the PHS network 1000 using a radio antenna 1010, and is connected with the PHS network 1000. Moreover, it is also possible to perform a voice message with the terminal 1024 of a communication link place which connects to the PDC network 1002 using a radio antenna 1012, and is connected with the PDC network 1002. Furthermore, a data

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telecommunication line can be established between the access servers 1018, and the desired information server (WWW server) 1026 can also be accessed via the Internet 1020. It will be transmitted to the radio equipment terminal 1004 via either the PHS network 1000 or the PDC network 1002, and the information in the information server 1026 will be displayed on the display 1006 of the wireless terminal unit 1004.

[0005] In the above-mentioned case, it is chosen by the input by the user who used the ten key 1008 etc. with any of the connection places of the wireless terminal unit 1004, i.e., the PHS network 1000 and the PDC network 1002, it connects. That is, the selection is based on a user's volition. When it follows, for example, a user performs voice communication, it just depends on a user's decision whether the PDC network 1002 with which a service area can be adapted also for high-speed migration widely is chosen, or the PHS network 1000 with a quick transmission speed of data communication is chosen. For this reason, when carrying out a voice message, as a result of choosing the PHS network 1000 for example, there was a case where that communication link will be cut during migration, the PDC network 1002 was chosen as data communication, consequently the top where a data transmission rate is low was highly asked also for a tariff.

[0006] Moreover, with the PC equipment 1028 shown in drawing 19, both the PHS data communication card 1030 and the wireless LAN card 1032 connect with PCMCIA card SUROAAI conte 1028a of PC equipment 1028. It connected with PHS terminal 1034 and the PHS data communication card 1030 has connected wireless LAN card equipment 1032 with the main phone 1036 through antenna section 1032a. PC equipment 1028 accesses the information server (WWW server) 1046 connected to the Internet 1044 through the wireless LAN card 1032, a main phone 1036, Ethernet 1038, a private network 1040, and the gateway 1042. Or it is also possible to access the information server 1046 through the PHS data communication card 1030, PHS terminal 1034, a base station 1048, the PHS network 1050, and the access server 1052. Moreover, it can communicate also with the terminal 1054 of a communication link place connected to the PHS network 1050.

[0007] with any of the connection places of the PC equipment 1028 of drawing 19, i.e., a private network 1040 and the PHS network 1050, it connects displays on the display unit of PC equipment 1028 -- having -- a private network 104 and the PHS network 1050 -- it is determined by it being alike, respectively and clicking corresponding icon 1028b by mouse cursor 1028c. Furthermore, the information on the information server 1046 is also downloadable with actuation of software, such as a WWW browser in PC equipment 1028.

[0008] Even if it is this case, radio is performed like the case where it is shown in above-mentioned drawing 18 because the user of PC equipment 1028 chooses the connection place of PC equipment 1028. Moreover, the connection place chosen once cannot be automatically switched during a communication link. For this reason, even if it is the case where the PC equipment 1028 connected to the private network 1040 needed to move indoors for example, therefore connection needs to be switched to the PHS network 1050, once it cuts the communication

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link with a private network 1040, it is necessary to re-connect with the PHS network 105. Therefore, complicated actuation will be required of a user.

[0009] Moreover, as a problem [ / above-mentioned drawing 18 and in the case of / both / drawing 19 ], in case two walkie-talkies are switched, since each walkie-talkie is independent, there is a problem that the physical layer of a walkie-talkie and a MAC layer are required respectively. Furthermore, in the case of drawing 19 , since the logic LSI for data communication etc. was required for both, problems, like it is needed by about two sets also had the weight of a walkie-talkie, power consumption, and price cost.

[0010] Furthermore, although the separate system has been conventionally built for every radio frequency, with the 2.4GHz band, the frequency band with two or more same systems called not only IEEE802.11 but HomeRF and Bluetooth is used. However, like the above, since the device of each system was independent, even if it was the same frequency band, as shown in drawing 19 , it needed to connect two or more wireless terminals. And in a 5.2GHz band or a 5.3GHz band, two or more wireless systems are likely to share a frequency similarly.

[0011] Moreover, since the change of the walkie-talkie of a wireless terminal unit is performed by a user's manual entry, the radio communications system connected whenever a location changes must be changed. When the contents of a communication link differed also in the same location, the walkie-talkie needed to be switched too. Furthermore, since two or more walkie-talkies were not able to be chosen as coincidence, the communication link of two or more contents referred to as telephoning was unrealizable, looking at an image.

[0012]

[Problem(s) to be Solved by the Invention] This invention solves such a technical problem and aims at offering a switchable wireless terminal unit for the radio communications system of a connection place automatically according to the contents of application, a communicative condition, a user's condition, a surrounding environmental condition, etc.

[0013]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is two or more radio communications systems of each and the connectable wireless terminal unit which adopt a different communication mode. In case it communicates between either of said two or more radio communications systems Based on a predetermined radio-transmission way selection criterion, it is characterized [ from ] by being the wireless terminal unit equipped with an optimal radio-transmission way selection means selectable at any time for the optimal radio-transmission way among two or more radio-transmission ways formed between the base transceiver stations of each of two or more of said radio communications systems.

[0014] According to this invention, it becomes possible to change the change of the radio communications system of a connection place automatically according to a user's condition etc. For this reason, it can mitigate and the troublesome actuation by the user can operate application appropriately.

[0015]

[Embodiment of the Invention] With reference to a drawing, the gestalt of

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operation of this invention is explained below. In the publication of the following drawings, the same or similar sign is given to the same or similar part. Below, the radio communications system and the radio approach of explaining the wireless terminal unit concerning this invention first, next starting this invention are explained using the gestalt of six operations.

[0016] (Wireless terminal unit concerning this invention) Drawing 1 is the outline block diagram showing the radio communications system containing the wireless terminal unit concerning this invention. The 1st communication network 10 with which this radio communications system intercommunicates, and the 2nd and 3rd communication networks 12 and 14 which make public connection, the 1st, 2nd, and 3rd communication networks 10, 12, and 14 -- with the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 which were alike, respectively and were connected the wireless terminal unit 22 in which the wireless connection with the communication networks 10, 12, and 14 which are alike, respectively and correspond through the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 is possible -- since -- it is constituted. An interface 24 is connected between the 1st communication network 10 and the 2nd communication network 12, and the interface 26 is connected between the 2nd communication network 12 and the 3rd communication network 14.

[0017] the wireless terminal unit 22 concerning this invention -- the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 -- it is alike, respectively, and it receives and radio is realized. the wireless terminal unit 22 -- the 1st, 2nd, and 3rd base stations 16, 18, and 20 -- respectively -- \*\* -- it has at least the wireless interface which can communicate. usually, each base stations 16, 18, and 20 -- each area of not all that can be communicated has lapped. Therefore, the wireless terminal unit 22 chooses from from the base transceiver station which can establish a communication link among the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20, and chooses the most suitable channel out of the communication link engine performance which application requires. In drawing 1 , the base station of radio where a base transceiver station 16 realizes intercommunication of a short distance like Bluetooth, and wireless LAN and HomeRF, and a base transceiver station 18 are base stations of a mobil radio communication network for the public like PDC, and the base station of the radio which can perform the communication link in which it was stabilized also to high-speed migration like the passing speed of an automobile, and a base transceiver station 109 are base stations of the radio for the public who offer migration of PHS or walking speed extent like high-speed migration access.

[0018] Next, the layer configuration of the wireless terminal unit 22 shown in drawing 1 is explained. Drawing 2 is drawing showing the 1st example of the layer configuration of the wireless terminal unit 22 of drawing 1 . This 1st example is an example about the selection approach of the radio equipment at the time of using a 2.4GHz band for the wireless section. At this 1st example, they are Bluetooth, HomeRF, and IEEE802.11 (IEEE802.11b is also included.). Hereafter, the physical layer and the MAC layer corresponding to each are constituted independently similarly, respectively. The communication link quality demanded in application (AP) by changing radio equipment is embodied, and further, as for wireless change

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control middleware (RLC), the QoS Management Department performs resending control and a flow control to an LLC layer or a TCP layer so that the quality which user application requires can be secured.

[0019] Drawing 3 is drawing showing the 2nd example of the layer configuration of the wireless terminal unit 22 of drawing 1. In this 2nd example, it has the application supervisory control section which manages the QoS requirements of user application, and wireless supervisory control middleware (RLC). furthermore, the wireless system which connects the physical layer and a MAC layer flexibly using the same hardware like a software walkie-talkie -- it is switchable. Based on the QoS information demanded from the application supervisory control section, wireless supervisory control middleware (RLC) controls a software walkie-talkie to control a software walkie-talkie and to fulfill the QoS information demanded. In this case, the walkie-talkie connected can consider Bluetooth, HomeRF, and IEEE802.11.

[0020] Drawing 4 is drawing showing the 3rd example of the layer configuration of the wireless terminal unit 22 of drawing 1. In this 3rd example, it has a data link, IP, TCP/UDP, etc. for every systems, such as Bluetooth, HomeRF, and IEEE802.11, as the physical layer. Furthermore, it has the application supervisory control section which performs the communication link quality demand from user application, the equipment which supervises a terminal or a user's condition by the cell, a sensor, etc., and interface change control middleware which changes the interface established for every system. The application supervisory control section chooses suitable radio equipment by changing the system interface which communication link middleware connects according to the algorithm defined beforehand based on the information which shows the terminal acquired from the communication link quality which user application requires, a cell, a sensor, etc., or a user's condition.

[0021] Drawing 5 is drawing showing the 4th example of the layer configuration of the wireless terminal unit 22 of drawing 1. This 4th example is an example about the selection approach of the radio equipment at the time of using for example, a 5GHz band. Although this 4th example consists of the application supervisory control section, wireless supervisory control middleware (RLC), etc., a MAC layer realizes the difference between systems with software. Furthermore, as for the physical layer, the object for 5.2GHz bands and the object for 5.3GHz bands are prepared, respectively. The application supervisory control section transmits the communication link quality which application requires to the wireless supervisory control middleware section (RLC), determines the radio equipment connected in the wireless supervisory control middleware section, and it connects with the required physical layer and it realizes a desired wireless system while making the system which connects a MAC layer correspond.

[0022] (Gestalt of the 1st operation) Next, the gestalt of operation of the 1st of this invention is explained. Drawing 6 is the outline block diagram showing the radio communications system concerning the gestalt of operation of the 1st of this invention. In drawing 6, the information server 34 which consists of multimedia information which contains an animation and a still picture in the information server 30 constituted by the 1st communication network 10 using individual are

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recording information, such as e-mail, the information server 32 constituted by the 2nd communication network 12 using advertising information, and the 3rd communication network 14 is connected as a communications partner of the wireless terminal unit 22, respectively. The wireless terminal unit 11 will choose a communication link place from among these information servers 30, 32, and 34.

[0023] Next, actuation of the gestalt of operation of the 1st of this invention is explained. First, the wireless terminal unit 22 chooses the information servers 30, 32, and 34 containing the contents which a user demands based on the version information of the dc-battery residue of the wireless terminal unit 22, the engine performance of the display screen, the contents of a demand from a user, the communication link quality that application requires, and application etc., and determines the communication networks 10, 12, and 14 connected from the result of the selection. For example, the case where the multimedia information containing an animation is received from the information server 34 is considered. When there are dc-battery residues of enough of the wireless terminal unit 22 and they can display an animation with the high definition display of the wireless terminal unit 22, the communication link middleware of the wireless terminal unit 22 performs the communication link with the information server 34 through the 3rd communication network 14. The information offered from the information server 34 is mass information which makes an animation a subject, and in order to carry this, the wireless terminal unit 22 connects with a base transceiver station 20 through the 3rd radio-transmission way. Furthermore, when the application of the wireless terminal unit 22 requires a mail transfer of coincidence from the information server 30, or when the effectiveness of lowering a communication link tariff by receiving advertising information from the information server 32 is expected, information is received from the information servers 30 and 32 through interfaces 24 and 26 if needed.

[0024] Moreover, when use of the 2nd radio-transmission way where transmission speed is lower than the 3rd radio-transmission way is enough, the communication link middleware of the wireless terminal unit 22 performs the communication link with the information server 34 through the 2nd advantageous radio-transmission way and 2nd advantageous communication network 12 from cost required for a communication link, and the field of power consumption. in such a case -- for example, the case of a transmission speed fewer than the 3rd communication network 14, or when the contents of an information transmission which application requires when there are few dc-battery residues move to a high speed, they are outside the area of the 3rd base transceiver station 20 -- etc. -- it generates for a reason.

[0025] Furthermore, when it can connect with the base transceiver station 16 of the 1st communication network 10 by intercommunication, the communication link middleware of the wireless terminal unit 22 performs the communication link with the information servers 30, 32, and 34 through the 1st radio-transmission way and 1st communication network 10. Since it does not necessarily generate in intercommunication whenever a communication link tariff is generally a communication link, it enables this to realize a cheap communication link.

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[0026] Moreover, since power consumption generally becomes large with a transmission system with the same one where transmission speed is more nearly high-speed, and the transmission quality, these selections act effective in extension of the operating time of the wireless terminal unit 22 by dc-battery actuation. Moreover, since the communication range is shorter than public radio, the operating time of the terminal by dc-battery actuation is extensible in communication link yard radio, similarly by communicating by making a transmitting output small.

[0027] Here, the concrete configuration of the wireless terminal unit 22 shown in above-mentioned drawing 1 and above-mentioned drawing 6 is explained. Drawing 7 is the block diagram showing the configuration of the wireless terminal unit 22. this wireless terminal unit 22 -- the communications control section 2201, the wireless receive sections 2202a, 2202b, and 2202c, Battery Unit 2203, an acceleration sensor 2204, a position sensor 2205, the terminal condition judging section 2206, a display 2207, an input unit 2208, the user application 2209, and the wireless transmitting sections 2210a, 2210b, and 2210c -- since -- it is constituted.

[0028] Next, reception actuation of the wireless terminal unit 22 of drawing 7 is explained using drawing 8 . Drawing 8 is a flow chart which shows the procedure of reception actuation of the wireless terminal unit 22 of drawing 7 . First, at first, the communications control section 2201 reads wireless receipt information from the wireless receive sections 2202a, 2202b, and 2202c, and judges an usable walkie-talkie from the wireless receipt information (step S101). then, a display 2207, an input unit 2208, and the user application 2209 -- each condition is read and the candidate of the walkie-talkie actually used out of an usable walkie-talkie is determined (step S102). usually, a display 2207, an input unit 2208, and the user application 2209 -- respectively -- since -- once the display status information, input unit status information, and demand QoS information which are outputted are stored in enclosure, such as memory which is not illustrated, they will be read into the communications control section 2201.

[0029] Next, the terminal condition judging section 2206 acquires acceleration information and positional information from an acceleration sensor 2204 and a position sensor 2205, and judges whether it is in the condition that the wireless terminal unit 22 can operate (step S103). Usually, the terminal condition judging information is once recorded on enclosure, such as memory which is not illustrated. And based on the terminal condition judging information stored in the enclosure, the communications control section 2201 judges the operating state of the wireless terminal unit 22, i.e., the operating state of the user of the wireless terminal unit 22; and judges the receiving engine performance required of the wireless terminal unit 22 (step S104). For example, in the condition that the user is not looking at the screen, reception of a real-time image is unnecessary. In this case, what is necessary is to reduce transmission speed and just to receive image data.

[0030] Next, the communications control section 2201 performs narrowing down of the walkie-talkie to be used based on the judgment result of step S104 (step S105). The use candidate of a walkie-talkie may be not only one but plural.

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However, when there are more than one, priority attachment shall be carried out by the algorithm defined beforehand. And one is chosen from the walkie-talkies which are use candidates (step S106), and it is referring to the wireless receipt information from the wireless receive sections 2202a, 2202b, and 2202c, and judges whether the communications control section 2201 can communicate by the selected candidate (step S107). And if there is the next candidate further (step S108 YES) and it is when the candidate does not satisfy conditions (step S107 NO), it will return to the above-mentioned step S106. On the other hand, if there is no next candidate (step S108 NO), data reception will be stopped (step S109) and reception actuation will be ended here.

[0031] If the walkie-talkie chosen at step S107 satisfies conditions (step S107 YES), it will determine as a walkie-talkie to be used (step S110). And if there is the next candidate further (step S111 YES), it will return to the above-mentioned step S106. On the other hand, if there is already no next candidate (step S111 NO), the communications control section 2201 will transmit a receiving mechanism signal to the wireless receive sections 2202a, 2202b, and 2202c, will choose the optimal walkie-talkie for reception (step S112), will start data reception (step S113), and will end reception actuation of the wireless terminal unit 22.

[0032] Next, the send action of the wireless terminal unit 22 of drawing 7 is explained using drawing 9. Drawing 9 is a flow chart which shows the procedure of the send action of the wireless terminal unit 22 of drawing 7. The communications control section 2201 checks first whether the data which should be transmitted exist at first (step S201). And if there is no transmit data (step S202 NO), it judges whether the waiting for transmit data is continued with the means of a timer etc., and in continuing, it will return to (step S213YES) and step S201. the case where it does not continue -- (step S213NO) -- data transmission is stopped immediately (step S210), and the send action of the wireless terminal unit 22 is ended.

[0033] On the other hand, if there is transmit data (step S202 YES), the communications control section 2201 will read terminal condition judging information, and will judge whether the wireless terminal unit 22 is in the condition which can be operated (step S203). Moreover, dc-battery residue information may be acquired from a dc-battery 2203 at this step S203. Then, it is judged whether the wireless terminal unit 22 is in the condition in which a send action is possible (step S204). For example, even if it is the case where the user application 2209 desires real-time transmission of the camera image by the user, when it is judged that a user is in a walk condition at the above-mentioned step S203, it judges that a right image cannot be transmitted (step S204 NO), and actuation (step S210) of not performing broadband communication required for a picture signal can be considered. Moreover, also when it is judged from dc-battery residue information that there are few residues of a dc-battery, you may judge that a send action is impossible. And a send action is ended here.

[0034] On the other hand, when judging that the wireless terminal unit 22 is in the condition in which a send action is possible, (step S204YES) and the communications control section 2201 read wireless receipt information (step S205), and determine the selection candidate of a walkie-talkie (step S206). It is

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because determining the selection candidate of a walkie-talkie based on wireless receipt information is usually performed by the pair here to the base transceiver station where transmission and reception are the same, so it is thought that transmission using the radio-transmission way which cannot receive information from a base transceiver station cannot be performed. However, in the case of the hybrid radio communications system which uses a different walkie-talkie between transmission and reception, for example, step S205 which is check actuation of a receive state can also be omitted.

[0035] And if one is chosen from the walkie-talkies which are selection candidates (step S207), and it judges whether the walkie-talkie is ready-for-sending ability, and there are (step S208NO) and the next candidate further when it cannot transmit (step S209 YES), it will return to the above-mentioned step S207. On the other hand, if there is no next candidate (step S209 NO), data transmission will be stopped (step S210) and a send action will be ended here. In addition, what is necessary is just to judge decision of the above-mentioned step S208 by the ability of the receiver used as a pair to receive the information information transmitted from a base transceiver station.

[0036] On the other hand, in being ready-for-sending ability, it opts for use of (step S208YES) and its walkie-talkie (step S211), and data transmission is started (step S212), and the send action of the wireless terminal unit 22 is ended. In addition, not only transmission but reception may be performed to coincidence.

[0037] What is necessary is here, just to perform priority attachment of the selected walkie-talkie in reception actuation of above-mentioned drawing 8, and the send action of drawing 9 as follows, for example. Drawing 10 is drawing for explaining the approach [ walkie-talkie / selected ] of priority attachment. this case where a, A, the transmission speed of a channel 2, and a time amount unit price are the cases where the example of drawing 10 (a) sets the communication link amount of data to M, and the transmission speed of a channel 1 and a time amount unit price are [ b, B, the transmission speed of a channel 3, and a time amount unit price ] c and C, respectively -- each channels 1, 2, and 3 -- each communication link cost is set to  $M(A/a)$ ,  $M(B/b)$ , and  $M(C/c)$ . Therefore, what is necessary is just to perform dominance ranking of a channel in the cheap order, if communication link cost is cheap in order of channels 2, 1, and 3.

[0038] A channel 1 is the case where the time amount charging system with which, as for the example of drawing 10 (b), a communication link tariff is determined according to time amount, the packet charging system with which, as for a channel 2, a communication link tariff is determined according to the number of packets, and a channel 3 are fixed amount tariffs. supposing the communication link tariff of a channel 2 is 1 about p and an average packet size per packet here -- marginal cost required for data transmission -- channels 1, 2, and 3 -- it is alike, respectively, it sets and can calculate with  $M(A/a)$ ,  $p(M/1)$ , and 0. In this case, what is necessary is just to attach the dominance ranking of channel selection to that order, if communication link cost is cheap in order of channels 3, 2, and 1.

[0039] By having the table of such count in the interior of a terminal, it becomes possible to choose the cheap radio channel of cost easily.

[0040] Moreover, ranking of such priority attachment of a channel can also be

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carried out using the factor of not only communication link cost like the above-mentioned example but others. For example, what is necessary is to give priority to the channel of a low power more, and just to determine a channel, when in the case of a personal digital assistant there are many dc-battery residues, priority is given to cost, a channel is determined and the dc-battery residue has decreased. As the channel decision approach of a low power, it is acquiring not only transmission speed but the received field strength information from a base station, and required transmitted power control to a base station can be performed, and a base station can also choose near and a radio channel with little power consumption most.

[0041] It is also possible to choose a base station according to the not selection but contents of contents by the pan and cost like the above-mentioned example. for example, in the case of the fixed form contents expected that the amount of data is settled in a certain amount of range in the example of drawing 10 (c) In the case of specific mold contents, such as real-time picture transmission in which accounting uses the channel 1 of a flat rate system for, and the range of the amount of data does not become settled Although a communication link tariff is cheap among the channels of the meter-rate system [ accounting ], area gives priority to and chooses the narrow channel 3, and subsequently, although the communication link tariff is comparatively high-priced than a channel 3, it searches and chooses the large channel 2 of a communications area.

[0042] By equipping the communications control section with such a selection algorithm, the power consumption of a terminal can be controlled and small amount-ization of the miniaturization of a terminal, huge-izing of communication link time amount, and a communication link tariff can be realized.

[0043] (Gestalt of the 2nd operation) Next, the gestalt of operation of the 2nd of this invention is explained. The gestalt of this 2nd operation shows the concrete example of application of the radio communications system concerning the gestalt of the 1st operation of the above. Drawing 11 is the outline block diagram of the communication system concerning the gestalt of operation of the 2nd of this invention.

[0044] In drawing 11 (a) the communication system of the gestalt of this 2nd operation It connects with the 1st communication network 36, the 2nd communication network 38, and the 1st communication network 36. The 1st base transceiver station 40 in which high-speed transmission is possible (for example, CDMA base transceiver station),

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to a wireless terminal unit, a radio communications system, and the radio approach.

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PRIOR ART

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[Description of the Prior Art] As for the conventional radio communications system, the communication link was performed using the separate frequency for every system. For this reason, a wireless terminal is connectable only with the radio communications system which is the terminal of a proper and corresponds at the radio communications system with which each is used. On the other hand, although the radio communication equipment of two or more classes was beforehand built in depending on the terminal and there was also a thing connectable with two or more radio communications systems, at once, it was connectable only with one system. Moreover, the switch of a radio communication equipment itself was performed by the hand control of the user of a wireless terminal.

[0003] In the radio communications system shown in drawing 18, the wireless terminal unit 1004 connectable with the PHS network 1000 and the PDC network 1002 called a dual mode terminal is used two communication networks and here. The thing wireless terminal unit 1004 is equipped with a display 1006, a ten key 1008, the radio antenna 1010 for PHS network 100, the radio antenna 1012 for PDC network 1002, and \*. moreover, the PHS network 1000 and the PHS network 1002 -- respectively -- being alike -- base transceiver stations 1014 and 1016 are connected and the wireless terminal unit 1004 makes wireless connection through each base transceiver stations 1014 and 1016 at the PHS network 1000 and the PDC network 1002. The PHS network 100 and the PDC network 1002 are connected with the Internet 1020 which is a public network through the access server 2109 corresponding to each.

[0004] The wireless terminal unit 1004 can perform a voice message with the terminal 1022 of a communication link place which connects to the PHS network 1000 using a radio antenna 1010, and is connected with the PHS network 1000. Moreover, it is also possible to perform a voice message with the terminal 1024 of a communication link place which connects to the PDC network 1002 using a radio antenna 1012, and is connected with the PDC network 1002. Furthermore, a data telecommunication line can be established between the access servers 1018, and the desired information server (WWW server) 1026 can also be accessed via the Internet 1020. It will be transmitted to the radio equipment terminal 1004 via either the PHS network 1000 or the PDC network 1002, and the information in the information server 1026 will be displayed on the display 1006 of the wireless

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terminal unit 1004.

[0005] In the above-mentioned case, it is chosen by the input by the user who used the ten key 1008 etc. with any of the connection places of the wireless terminal unit 1004, i.e., the PHS network 1000 and the PDC network 1002, it connects. That is, the selection is based on a user's volition. When it follows, for example, a user performs voice communication, it just depends on a user's decision whether the PDC network 1002 with which a service area can be adapted also for high-speed migration widely is chosen, or the PHS network 1000 with a quick transmission speed of data communication is chosen. For this reason, when carrying out a voice message, as a result of choosing the PHS network 1000 for example, there was a case where that communication link will be cut during migration, the PDC network 1002 was chosen as data communication, consequently the top where a data transmission rate is low was highly asked also for a tariff.

[0006] Moreover, with the PC equipment 1028 shown in drawing 19, both the PHS data communication card 1030 and the wireless LAN card 1032 connect with PCMCIA card SUROAAI conte 1028a of PC equipment 1028. It connected with PHS terminal 1034 and the PHS data communication card 1030 has connected wireless LAN card equipment 1032 with the main phone 1036 through antenna section 1032a. PC equipment 1028 accesses the information server (WWW server) 1046 connected to the Internet 1044 through the wireless LAN card 1032, a main phone 1036, Ethernet 1038, a private network 1040, and the gateway 1042. Or it is also possible to access the information server 1046 through the PHS data communication card 1030, PHS terminal 1034, a base station 1048, the PHS network 1050, and the access server 1052. Moreover, it can communicate also with the terminal 1054 of a communication link place connected to the PHS network 1050.

[0007] with any of the connection places of the PC equipment 1028 of drawing 19, i.e., a private network 1040 and the PHS network 1050, it connects displays on the display unit of PC equipment 1028 -- having -- a private network 104 and the PHS network 1050 -- it is determined by it being alike, respectively and clicking corresponding icon 1028b by mouse cursor 1028c. Furthermore, the information on the information server 1046 is also downloadable with actuation of software, such as a WWW browser in PC equipment 1028.

[0008] Even if it is this case, radio is performed like the case where it is shown in above-mentioned drawing 18 because the user of PC equipment 1028 chooses the connection place of PC equipment 1028. Moreover, the connection place chosen once cannot be automatically switched during a communication link. For this reason, even if it is the case where the PC equipment 1028 connected to the private network 1040 needed to move indoors for example, therefore connection needs to be switched to the PHS network 1050, once it cuts the communication link with a private network 1040, it is necessary to re-connect with the PHS network 105. Therefore, complicated actuation will be required of a user.

[0009] Moreover, as a problem [ / above-mentioned drawing 18 and in the case of / both / drawing 19 ], in case two walkie-talkies are switched, since each walkie-talkie is independent, there is a problem that the physical layer of a walkie-

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talkie and a MAC layer are required respectively. Furthermore, in the case of drawing 19 , since the logic LSI for data communication etc. was required for both, problems, like it is needed by about two sets also had the weight of a walkie-talkie, power consumption, and price cost.

[0010] Furthermore, although the separate system has been conventionally built for every radio frequency, with the 2.4GHz band, the frequency band with two or more same systems called not only IEEE802.11 but HomeRF and Bluetooth is used. However, like the above, since the device of each system was independent, even if it was the same frequency band, as shown in drawing 19 , it needed to connect two or more wireless terminals. And in a 5.2GHz band or a 5.3GHz band, two or more wireless systems are likely to share a frequency similarly.

[0011] Moreover, since the change of the walkie-talkie of a wireless terminal unit is performed by a user's manual entry, the radio communications system connected whenever a location changes must be changed. When the contents of a communication link differed also in the same location, the walkie-talkie needed to be switched too. Furthermore, since two or more walkie-talkies were not able to be chosen as coincidence, the communication link of two or more contents referred to as telephoning was unrealizable, looking at an image.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] According to this invention, the wireless terminal unit which can change the change of the radio communications system of a connection place automatically according to a user's condition etc. is realizable. For this reason, the change by the user becomes unnecessary and a user needs to perform troublesome change actuation. Moreover, automatic switching enables it to operate the application of a wireless terminal unit more appropriately.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] This invention solves such a technical problem and aims at offering a switchable wireless terminal unit for the radio communications system of a connection place automatically according to the contents of application, a communicative condition, a user's condition, a surrounding environmental condition, etc.

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MEANS

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[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is two or more radio communications systems of each and the connectable wireless terminal unit which adopt a different communication mode. In case it communicates between either of said two or more radio communications systems Based on a predetermined radio-transmission way selection criterion, it is characterized [ from ] by being the wireless terminal unit equipped with an optimal radio-transmission way selection means selectable at any time for the optimal radio-transmission way among two or more radio-transmission ways formed between the base transceiver stations of each of two or more of said radio communications systems.

[0014] According to this invention, it becomes possible to change the change of the radio communications system of a connection place automatically according to a user's condition etc. For this reason, it can mitigate and the troublesome actuation by the user can operate application appropriately.

[0015]

[Embodiment of the Invention] With reference to a drawing, the gestalt of operation of this invention is explained below. In the publication of the following drawings, the same or similar sign is given to the same or similar part. Below, the radio communications system and the radio approach of explaining the wireless terminal unit concerning this invention first, next starting this invention are explained using the gestalt of six operations.

[0016] (Wireless terminal unit concerning this invention) Drawing 1 is the outline block diagram showing the radio communications system containing the wireless terminal unit concerning this invention. The 1st communication network 10 with which this radio communications system intercommunicates, and the 2nd and 3rd communication networks 12 and 14 which make public connection, the 1st, 2nd, and 3rd communication networks 10, 12, and 14 -- with the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 which were alike, respectively and were connected the wireless terminal unit 22 in which the wireless connection with the communication networks 10, 12, and 14 which are alike, respectively and correspond through the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 is possible -- since -- it is constituted. An interface 24 is connected between the 1st communication network 10 and the 2nd communication network 12, and the interface 26 is connected between the 2nd communication network 12 and the 3rd

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communication network 14.

[0017] the wireless terminal unit 22 concerning this invention -- the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20 -- it is alike, respectively, and it receives and radio is realized. the wireless terminal unit 22 -- the 1st, 2nd, and 3rd base stations 16, 18, and 20 -- respectively -- \*\* -- it has at least the wireless interface which can communicate. usually, each base stations 16, 18, and 20 -- each area of not all that can be communicated has lapped. Therefore, the wireless terminal unit 22 chooses from from the base transceiver station which can establish a communication link among the 1st, 2nd, and 3rd base transceiver stations 16, 18, and 20, and chooses the most suitable channel out of the communication link engine performance which application requires. In drawing 1 , the base station of radio where a base transceiver station 16 realizes intercommunication of a short distance like Bluetooth, and wireless LAN and HomeRF, and a base transceiver station 18 are base stations of a mobil radio communication network for the public like PDC, and the base station of the radio which can perform the communication link in which it was stabilized also to high-speed migration like the passing speed of an automobile, and a base transceiver station 109 are base stations of the radio for the public who offer migration of PHS or walking speed extent like high-speed migration access.

[0018] Next, the layer configuration of the wireless terminal unit 22 shown in drawing 1 is explained. Drawing 2 is drawing showing the 1st example of the layer configuration of the wireless terminal unit 22 of drawing 1 . This 1st example is an example about the selection approach of the radio equipment at the time of using a 2.4GHz band for the wireless section. At this 1st example, they are Bluetooth, HomeRF, and IEEE802.11 (IEEE802.11b is also included.). Hereafter, the physical layer and the MAC layer corresponding to each are constituted independently similarly, respectively. The communication link quality demanded in application (AP) by changing radio equipment is embodied, and further, as for wireless change control middleware (RLC), the QoS Management Department performs resending control and a flow control to an LLC layer or a TCP layer so that the quality which user application requires can be secured.

[0019] Drawing 3 is drawing showing the 2nd example of the layer configuration of the wireless terminal unit 22 of drawing 1 . In this 2nd example, it has the application supervisory control section which manages the QoS requirements of user application, and wireless supervisory control middleware (RLC). furthermore, the wireless system which connects the physical layer and a MAC layer flexibly using the same hardware like a software walkie-talkie -- it is switchable. Based on the QoS information demanded from the application supervisory control section, wireless supervisory control middleware (RLC) controls a software walkie-talkie to control a software walkie-talkie and to fulfill the QoS information demanded. In this case, the walkie-talkie connected can consider Bluetooth, HomeRF, and IEEE802.11.

[0020] Drawing 4 is drawing showing the 3rd example of the layer configuration of the wireless terminal unit 22 of drawing 1 . In this 3rd example, it has a data link, IP, TCP/UDP, etc. for every systems, such as Bluetooth, HomeRF, and IEEE802.11, as the physical layer. Furthermore, it has the application supervisory control

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section which performs the communication link quality demand from user application, the equipment which supervises a terminal or a user's condition by the cell, a sensor, etc., and interface change control middleware which changes the interface established for every system. The application supervisory control section chooses suitable radio equipment by changing the system interface which communication link middleware connects according to the algorithm defined beforehand based on the information which shows the terminal acquired from the communication link quality which user application requires, a cell, a sensor, etc., or a user's condition.

[0021] Drawing 5 is drawing showing the 4th example of the layer configuration of the wireless terminal unit 22 of drawing 1. This 4th example is an example about the selection approach of the radio equipment at the time of using for example, a 5GHz band. Although this 4th example consists of the application supervisory control section, wireless supervisory control middleware (RLC), etc., a MAC layer realizes the difference between systems with software. Furthermore, as for the physical layer, the object for 5.2GHz bands and the object for 5.3GHz bands are prepared, respectively. The application supervisory control section transmits the communication link quality which application requires to the wireless supervisory control middleware section (RLC), determines the radio equipment connected in the wireless supervisory control middleware section, and it connects with the required physical layer and it realizes a desired wireless system while making the system which connects a MAC layer correspond.

[0022] (Gestalt of the 1st operation) Next, the gestalt of operation of the 1st of this invention is explained. Drawing 6 is the outline block diagram showing the radio communications system concerning the gestalt of operation of the 1st of this invention. In drawing 6, the information server 34 which consists of multimedia information which contains an animation and a still picture in the information server 30 constituted by the 1st communication network 10 using individual are recording information, such as e-mail, the information server 32 constituted by the 2nd communication network 12 using advertising information, and the 3rd communication network 14 is connected as a communications partner of the wireless terminal unit 22, respectively. The wireless terminal unit 11 will choose a communication link place from among these information servers 30, 32, and 34.

[0023] Next, actuation of the gestalt of operation of the 1st of this invention is explained. First, the wireless terminal unit 22 chooses the information servers 30, 32, and 34 containing the contents which a user demands based on the version information of the dc-battery residue of the wireless terminal unit 22, the engine performance of the display screen, the contents of a demand from a user, the communication link quality that application requires, and application etc., and determines the communication networks 10, 12, and 14 connected from the result of the selection. For example, the case where the multimedia information containing an animation is received from the information server 34 is considered. When there are dc-battery residues of enough of the wireless terminal unit 22 and they can display an animation with the high definition display of the wireless terminal unit 22, the communication link middleware of the wireless terminal unit

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22 performs the communication link with the information server 34 through the 3rd communication network 14. The information offered from the information server 34 is mass information which makes an animation a subject, and in order to carry this, the wireless terminal unit 22 connects with a base transceiver station 20 through the 3rd radio-transmission way. Furthermore, when the application of the wireless terminal unit 22 requires a mail transfer of coincidence from the information server 30, or when the effectiveness of lowering a communication link tariff by receiving advertising information from the information server 32 is expected, information is received from the information servers 30 and 32 through interfaces 24 and 26 if needed.

[0024] Moreover, when use of the 2nd radio-transmission way where transmission speed is lower than the 3rd radio-transmission way is enough, the communication link middleware of the wireless terminal unit 22 performs the communication link with the information server 34 through the 2nd advantageous radio-transmission way and 2nd advantageous communication network 12 from cost required for a communication link, and the field of power consumption. in such a case -- for example, the case of a transmission speed fewer than the 3rd communication network 14, or when the contents of an information transmission which application requires when there are few dc-battery residues move to a high speed, they are outside the area of the 3rd base transceiver station 20 -- etc. -- it generates for a reason.

[0025] Furthermore, when it can connect with the base transceiver station 16 of the 1st communication network 10 by intercommunication, the communication link middleware of the wireless terminal unit 22 performs the communication link with the information servers 30, 32, and 34 through the 1st radio-transmission way and 1st communication network 10. Since it does not necessarily generate in intercommunication whenever a communication link tariff is generally a communication link, it enables this to realize a cheap communication link.

[0026] Moreover, since power consumption generally becomes large with a transmission system with the same one where transmission speed is more nearly high-speed, and the transmission quality, these selections act effective in extension of the operating time of the wireless terminal unit 22 by dc-battery actuation. Moreover, since the communication range is shorter than public radio, the operating time of the terminal by dc-battery actuation is extensible in communication link yard radio, similarly by communicating by making a transmitting output small.

[0027] Here, the concrete configuration of the wireless terminal unit 22 shown in above-mentioned drawing 1 and above-mentioned drawing 6 is explained.

Drawing 7 is the block diagram showing the configuration of the wireless terminal unit 22. this wireless terminal unit 22 -- the communications control section 2201, the wireless receive sections 2202a, 2202b, and 2202c, Battery Unit 2203, an acceleration sensor 2204, a position sensor 2205, the terminal condition judging section 2206, a display 2207, an input unit 2208, the user application 2209, and the wireless transmitting sections 2210a, 2210b, and 2210c -- since -- it is constituted.

[0028] Next, reception actuation of the wireless terminal unit 22 of drawing 7 is

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explained using drawing 8 . Drawing 8 is a flow chart which shows the procedure of reception actuation of the wireless terminal unit 22 of drawing 7 . First, at first, the communications control section 2201 reads wireless receipt information from the wireless receive sections 2202a, 2202b, and 2202c, and judges an usable walkie-talkie from the wireless receipt information (step S101). then, a display 2207, an input unit 2208, and the user application 2209 -- each condition is read and the candidate of the walkie-talkie actually used out of an usable walkie-talkie is determined (step S102). usually, a display 2207, an input unit 2208, and the user application 2209 -- respectively -- since -- once the display status information, input unit status information, and demand QoS information which are outputted are stored in enclosure, such as memory which is not illustrated, they will be read into the communications control section 2201.

[0029] Next, the terminal condition judging section 2206 acquires acceleration information and positional information from an acceleration sensor 2204 and a position sensor 2205, and judges whether it is in the condition that the wireless terminal unit 22 can operate (step S103). Usually, the terminal condition judging information is once recorded on enclosure, such as memory which is not illustrated. And based on the terminal condition judging information stored in the enclosure, the communications control section 2201 judges the operating state of the wireless terminal unit 22, i.e., the operating state of the user of the wireless terminal unit 22, and judges the receiving engine performance required of the wireless terminal unit 22 (step S104). For example, in the condition that the user is not looking at the screen, reception of a real-time image is unnecessary. In this case, what is necessary is to reduce transmission speed and just to receive image data.

[0030] Next, the communications control section 2201 performs narrowing down of the walkie-talkie to be used based on the judgment result of step S104 (step S105). The use candidate of a walkie-talkie may be not only one but plural. However, when there are more than one, priority attachment shall be carried out by the algorithm defined beforehand. And one is chosen from the walkie-talkies which are use candidates (step S106), and it is referring to the wireless receipt information from the wireless receive sections 2202a, 2202b, and 2202c, and judges whether the communications control section 2201 can communicate by the selected candidate (step S107). And if there is the next candidate further (step S108 YES) and it is when the candidate does not satisfy conditions (step S107 NO), it will return to the above-mentioned step S106. On the other hand, if there is no next candidate (step S108 NO), data reception will be stopped (step S109) and reception actuation will be ended here.

[0031] If the walkie-talkie chosen at step S107 satisfies conditions (step S107 YES), it will determine as a walkie-talkie to be used (step S110). And if there is the next candidate further (step S111 YES), it will return to the above-mentioned step S106. On the other hand, if there is already no next candidate (step S111 NO), the communications control section 2201 will transmit a receiving mechanism signal to the wireless receive sections 2202a, 2202b, and 2202c, will choose the optimal walkie-talkie for reception (step S112), will start data reception (step S113), and will end reception actuation of the wireless terminal unit 22.

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[0032] Next, the send action of the wireless terminal unit 22 of drawing 7 is explained using drawing 9 . Drawing 9 is a flow chart which shows the procedure of the send action of the wireless terminal unit 22 of drawing 7 . The communications control section 2201 checks first whether the data which should be transmitted exist at first (step S201). And if there is no transmit data (step S202 NO), it judges whether the waiting for transmit data is continued with the means of a timer etc., and in continuing, it will return to (step S213YES) and step S201. the case where it does not continue -- (step S213NO) -- data transmission is stopped immediately (step S210), and the send action of the wireless terminal unit 22 is ended.

[0033] On the other hand, if there is transmit data (step S202 YES), the communications control section 2201 will read terminal condition judging information, and will judge whether the wireless terminal unit 22 is in the condition which can be operated (step S203). Moreover, dc-battery residue information may be acquired from a dc-battery 2203 at this step S203. Then, it is judged whether the wireless terminal unit 22 is in the condition in which a send action is possible (step S204). For example, even if it is the case where the user application 2209 desires real-time transmission of the camera image by the user, when it is judged that a user is in a walk condition at the above-mentioned step S203, it judges that a right image cannot be transmitted (step S204 NO), and actuation (step S210) of not performing broadband communication required for a picture signal can be considered. Moreover, also when it is judged from dc-battery residue information that there are few residues of a dc-battery, you may judge that a send action is impossible. And a send action is ended here.

[0034] On the other hand, when judging that the wireless terminal unit 22 is in the condition in which a send action is possible, (step S204YES) and the communications control section 2201 read wireless receipt information (step S205), and determine the selection candidate of a walkie-talkie (step S206). It is because determining the selection candidate of a walkie-talkie based on wireless receipt information is usually performed by the pair here to the base transceiver station where transmission and reception are the same, so it is thought that transmission using the radio-transmission way which cannot receive information from a base transceiver station cannot be performed. However, in the case of the hybrid radio communications system which uses a different walkie-talkie between transmission and reception, for example, step S205 which is check actuation of a receive state can also be omitted.

[0035] And if one is chosen from the walkie-talkies which are selection candidates (step S207), and it judges whether the walkie-talkie is ready-for-sending ability, and there are (step S208NO) and the next candidate further when it cannot transmit (step S209 YES), it will return to the above-mentioned step S207. On the other hand, if there is no next candidate (step S209 NO), data transmission will be stopped (step S210) and a send action will be ended here. In addition, what is necessary is just to judge decision of the above-mentioned step S208 by the ability of the receiver used as a pair to receive the information information transmitted from a base transceiver station.

[0036] On the other hand, in being ready-for-sending ability, it opts for use of

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(step S208YES) and its walkie-talkie (step S211), and data transmission is started (step S212), and the send action of the wireless terminal unit 22 is ended. In addition, not only transmission but reception may be performed to coincidence.

[0037] What is necessary is here, just to perform priority attachment of the selected walkie-talkie in reception actuation of above-mentioned drawing 8, and the send action of drawing 9 as follows, for example. Drawing 10 is drawing for explaining the approach [ walkie-talkie / selected ] of priority attachment. this case where a, A, the transmission speed of a channel 2, and a time amount unit price are the cases where the example of drawing 10 (a) sets the communication link amount of data to M, and the transmission speed of a channel 1 and a time amount unit price are [ b, B, the transmission speed of a channel 3, and a time amount unit price ] c and C, respectively -- each channels 1, 2, and 3 -- each communication link cost is set to  $M (A/a)$ ,  $M (B/b)$ , and  $M (C/c)$ . Therefore, what is necessary is just to perform dominance ranking of a channel in the cheap order, if communication link cost is cheap in order of channels 2, 1, and 3.

[0038] A channel 1 is the case where the time amount charging system with which, as for the example of drawing 10 (b), a communication link tariff is determined according to time amount, the packet charging system with which, as for a channel 2, a communication link tariff is determined according to the number of packets, and a channel 3 are fixed amount tariffs. supposing the communication link tariff of a channel 2 is 1 about p and an average packet size per packet here -- marginal cost required for data transmission -- channels 1, 2, and 3 -- it is alike, respectively, it sets and can calculate with  $M (A/a)$ ,  $p (M/1)$ , and 0. In this case, what is necessary is just to attach the dominance ranking of channel selection to that order, if communication link cost is cheap in order of channels 3, 2, and 1.

[0039] By having the table of such count in the interior of a terminal, it becomes possible to choose the cheap radio channel of cost easily.

[0040] Moreover, ranking of such priority attachment of a channel can also be carried out using the factor of not only communication link cost like the above-mentioned example but others. For example, what is necessary is to give priority to the channel of a low power more, and just to determine a channel, when in the case of a personal digital assistant there are many dc-battery residues, priority is given to cost, a channel is determined and the dc-battery residue has decreased. As the channel decision approach of a low power, it is acquiring not only transmission speed but the received field strength information from a base station, and required transmitted power control to a base station can be performed, and a base station can also choose near and a radio channel with little power consumption most.

[0041] It is also possible to choose a base station according to the not selection but contents of contents by the pan and cost like the above-mentioned example. for example, in the case of the fixed form contents expected that the amount of data is settled in a certain amount of range in the example of drawing 10 (c) In the case of specific mold contents, such as real-time picture transmission in which accounting uses the channel 1 of a flat rate system for, and the range of the amount of data does not become settled Although a communication link tariff is cheap among the channels of the meter-rate system [ accounting ], area gives

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priority to and chooses the narrow channel 3, and subsequently, although the communication link tariff is comparatively high-priced than a channel 3, it searches and chooses the large channel 2 of a communications area.

[0042] By equipping the communications control section with such a selection algorithm, the power consumption of a terminal can be controlled and small amount-ization of the miniaturization of a terminal, huge-izing of communication link time amount, and a communication link tariff can be realized.

[0043] (Gestalt of the 2nd operation) Next, the gestalt of operation of the 2nd of this invention is explained. The gestalt of this 2nd operation shows the concrete example of application of the radio communications system concerning the gestalt of the 1st operation of the above. Drawing 11 is the outline block diagram of the communication system concerning the gestalt of operation of the 2nd of this invention.

[0044] In drawing 11 (a) the communication system of the gestalt of this 2nd operation It connects with the 1st communication network 36, the 2nd communication network 38, and the 1st communication network 36. The 1st base transceiver station 40 in which high-speed transmission is possible (for example, CDMA base transceiver station), the wireless terminal unit 44 which radiocommunicates between the 2nd base transceiver station (for example, base transceiver station of PHS) 42 which connects with the 2nd communication network 38 and performs transmission [ low speed / base transceiver station / 40 / 1st ], and the 1st and 2nd base transceiver stations 40 and 42 -- since -- it is constituted. The wireless terminal unit 44 is equipped with the acceleration sensor 4403 prepared in parallel with an antenna 4401, a display 4402, and a display 4402. And the wireless terminal unit 44 forms the high-speed radio-transmission way 46 between the 1st base transceiver station 40, and forms the low-speed radio-transmission way 48 between the 2nd base transceiver station 42.

[0045] Drawing 11 (a) shows the condition that the user of the wireless terminal unit 44 is just looking at the image currently displayed on the display 4402 of the wireless terminal unit 44. In this case, the acceleration sensor 4403 with which the wireless terminal unit 44 was equipped will be located in the direction in which the wireless terminal unit 44 detects the gravity direction. Thereby, it can be detected as an acceleration sensor 4403 having the display 4402 of the wireless terminal unit 44 in the direction of facing up. Because, the personal digital assistant with a screen display will be located below a user's eye line, and it will usually be viewed and listened to the screen. Therefore, if it detects that a terminal is the direction of facing up, it will become possible to judge that the user is looking at the screen. And if a user is the case where it is viewing and listening to for example, a real-time image, the wireless terminal unit 44 will form the high-speed radio-transmission way 46 between the 1st base transceiver station 40, and will make it possible to display a real-time image in the condition of seeing the screen that a user does not have stress.

[0046] On the other hand, as shown in drawing 11 (b), when the display 4402 of the wireless terminal unit 44 is put on length or the flesh-side sense, a user is usually considered not to see the screen. In this case, it is unnecessary to receive an image on real time. Then, when detected as the wireless terminal unit 44 being

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put on length or the flesh-side sense by the acceleration sensor 4403, the communication link of a user data etc. is connected to the 2nd base transceiver station 42 through the low speed radio channel 48. Data communication can be realized without this performing high-speed big radio of power consumption. For this reason, the dc-battery specification ratio of the wireless terminal unit 44 can be made small. Furthermore, in the case of drawing 11 (b), reduction of the further power consumption is also possible by indicating a display 4402 an OFF state.

[0047] the product made from analog DEBAISESU which is a two-dimensional mold acceleration sensor as an acceleration sensor 4403 of drawing 11 , for example -- what is necessary is just to use ADXL202JC In this acceleration sensor, it is possible to detect the physical relationship over the gravity direction of a terminal with biaxial synthetic acceleration. Moreover, although the exact gravity direction cannot be detected when a terminal is in an acceleration-and-deceleration condition, it is possible by turning this acceleration sensor in the direction of a three-dimension eye, and extending it one more set further, to grasp the gravity direction in a three dimension to accuracy more.

[0048] The high-speed radio-transmission way 46 is used only for the going-down link from the 1st base transceiver station 40 to the wireless terminal unit 44, and you may make it an uphill link use the low-speed radio channel 48 in the gestalt of operation of the 3rd of this invention. In this case, power consumption is made small more and a terminal price can be made cheap by reduction-ization of the number of components of the wireless terminal unit 44.

[0049] (Gestalt of the 3rd operation) Next, the gestalt of operation of the 3rd of this invention is explained. The gestalt of this 3rd operation as well as the gestalt of the 2nd operation of the above shows the concrete example of application of the radio communications system concerning the gestalt of the 1st operation of the above. Drawing 12 is the outline block diagram of the communication system concerning the gestalt of operation of the 3rd of this invention.

[0050] In drawing 12 , the wireless terminal unit 50 shall receive at least the electric wave of the 1st base transceiver station 54 for home use installed in the house 52 in the house 52, and the 2nd base transceiver station 56 for the public installed out of the house 52. Although the wireless terminal unit 50 in a house 52 is connectable with all of the 1st base transceiver station 54 and the 2nd base transceiver station 56 with a channel change The 1st base transceiver station 54 shall have reported ID of the purport which is a home base transceiver station in a house 52 in a part of the information channel, and, similarly the 2nd base transceiver station 56 shall have reported ID of the purport which is a base transceiver station for the public in a part of the information channel.

[0051] In this case, the wireless terminal unit 50 can communicate the quality stabilized by giving priority to connection with the 1st base transceiver station 54, and further, in order that an electric wave may decline with the wall of a house 52, it becomes possible [ decreasing the electric-wave interference to the exterior and connecting ].

[0052] Moreover, since the same radio frequency is used when the wireless terminal unit 50 moves outside from from among houses 52, when connecting

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with the 2nd base transceiver station 56, it can connect using the same transceiver circuit, and it becomes possible to decrease a miniaturization and cost of a terminal.

[0053] The judgment whether it is inside a house 52 or outside needed is possible by connecting with the 1st base transceiver station 54, when the received field strength of the information on the 1st base transceiver station 54 is measured and the received field strength of the 1st base transceiver station 54 exceeds a predetermined threshold. Moreover, it is also possible the approach using a surrounding illuminance as an option, and by using GPS (positioning satellite) to judge the inside and outside of a house from reference of the positional information of a terminal and map information.

[0054] (Gestalt of the 4th operation) Next, the gestalt of operation of the 4th of this invention is explained. Drawing 13 is the outline block diagram of the communication system concerning the gestalt of operation of the 4th of this invention.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram showing the radio communications system containing the wireless terminal unit concerning this invention.

[Drawing 2] It is drawing showing the 1st example of the layer configuration of the wireless terminal unit 22 of drawing 1 .

[Drawing 3] It is drawing showing the 2nd example of the layer configuration of the wireless terminal unit 22 of drawing 1 .

[Drawing 4] It is drawing showing the 3rd example of the layer configuration of the wireless terminal unit 22 of drawing 1 .

[Drawing 5] It is drawing showing the 4th example of the layer configuration of the wireless terminal unit 22 of drawing 1 .

[Drawing 6] It is the outline block diagram showing the radio communications system concerning the gestalt of operation of the 1st of this invention.

[Drawing 7] It is the block diagram showing the configuration of the wireless terminal unit 22 of drawing 6 .

[Drawing 8] It is the flow chart which shows the procedure of reception actuation of the wireless terminal unit 22 of drawing 7 .

[Drawing 9] It is the flow chart which shows the procedure of the send action of the wireless terminal unit 22 of drawing 7 .

[Drawing 10] It is drawing for explaining the approach [ walkie-talkie ] of priority attachment.

[Drawing 11] It is the outline block diagram of the communication system concerning the gestalt of operation of the 2nd of this invention.

[Drawing 12] It is the outline block diagram of the communication system concerning the gestalt of operation of the 3rd of this invention.

[Drawing 13] It is the outline block diagram of the communication system concerning the gestalt of operation of the 4th of this invention.

[Drawing 14] It is the outline block diagram of the communication system concerning the gestalt of operation of the 5th of this invention.

[Drawing 15] It is drawing for explaining the communication system concerning the gestalt of operation of the 6th of this invention.

[Drawing 16] It is drawing showing another configuration of the 6th of the gestalt of operation of this invention.

[Drawing 17] It is the block diagram showing the example of a configuration of

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drawing 15 and the wireless terminal unit 92,120 of drawing 16 .

[Drawing 18] It is drawing showing the conventional example of the radio structure of a system.

[Drawing 19] It is drawing showing other examples of a configuration of the conventional radio communications system.

[Description of Notations]

10, 12, 14, 36, 38, 58, 72, 86,120,150 Communication network  
 16, 18, 20, 40, 42, 54, 56, 68, 82, 94, 116, 124, 146, 1014, 1016, 1048 Base transceiver station  
 22, 44, 50, 64, 78, 80, 92, 114, 122, 148, 1004 Wireless terminal unit  
 24, 26, 60, 96, 144, 1042 Interface (internetwork-connection equipment)  
 28, 30, 32, 34, 74, 88, 1026, 1046 Information server  
 46 High-speed Radio-Transmission Way  
 48 Low-speed Radio-Transmission Way  
 52,142 House  
 62 Digital Camera Equipment  
 66 Building  
 70 Communications Area  
 76 Bag  
 84 Automatic Gate Machine  
 90 Rail Car  
 98 Communications Control Section  
 100 Table  
 102 Doctor  
 104,130 Communication link terminating set  
 106,110,134 Communication terminal  
 108,128 A fire department, emergency pin center,large  
 112,140 The persons concerned, such as a relative  
 118 Service Provider  
 126 Hospital  
 136 Fire Department or Emergency Pin Center,large Official in Charge  
 138 Medical Staff  
 152 Infrared Sensor  
 154 Camera Equipment  
 156, 2204, 4403 Acceleration sensor  
 158 Pulse Wave Sensor  
 160 2205 Position sensor  
 162 Health Management Information Storage Section  
 164 Image-Processing Section  
 166 User Condition Judging Section  
 168 Communications Control Section  
 170 Communication Link Place List  
 172 Communications Processing Section  
 174 2202 Wireless receive section  
 176 2210 Wireless transmitting section  
 1000 PHS Network

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1002 PDC Network  
1006 Display  
1008 Ten Key  
1010 1012 Radio antenna  
1018 1052 Access server  
1020 1044 Internet  
1022, 1024, 1054 The end of a communication link tip  
1028 PC Equipment  
1028a PCMCIA card slot  
1028b Icon  
1028c Mouse cursor  
1030 PHS Data Communication Card  
1032 Wireless LAN Card Equipment  
1034 PHS Terminal  
1036 Main Phone  
1038 Ethernet  
1040 Private Network  
1050 PHS Network  
2201 Communications Control Section  
2203 Dc-battery  
2206 Terminal Condition Judging Section  
2207 4402 Display  
2208 Input Unit  
2209 User Application  
4401 Antenna

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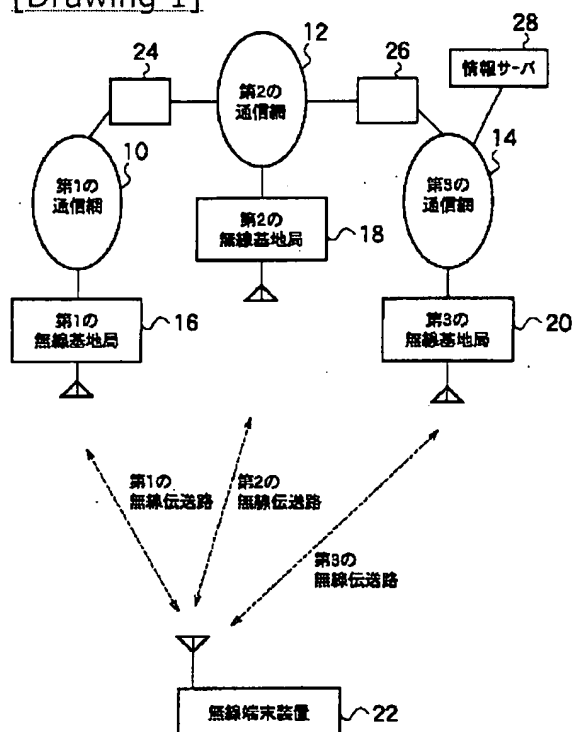
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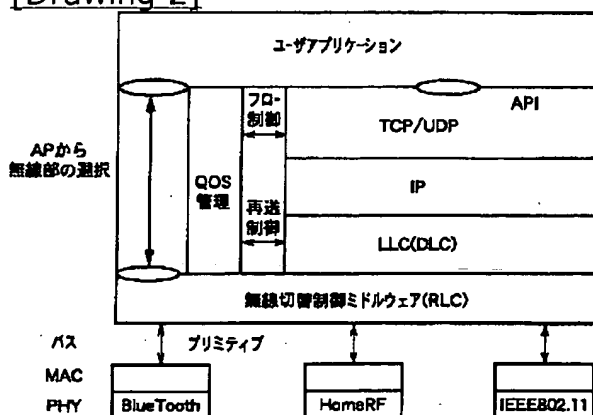
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## DRAWINGS

[Drawing 1]

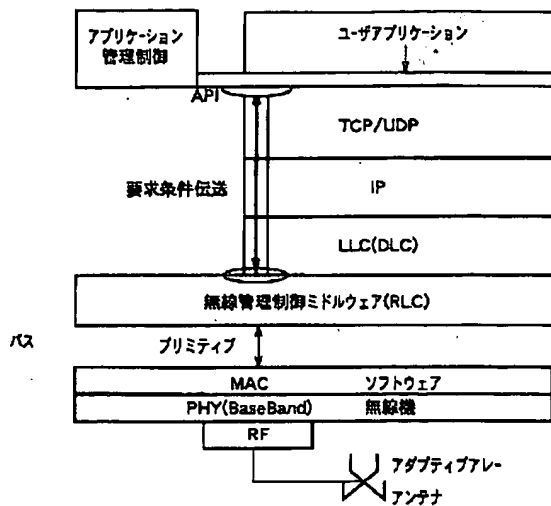


[Drawing 2]

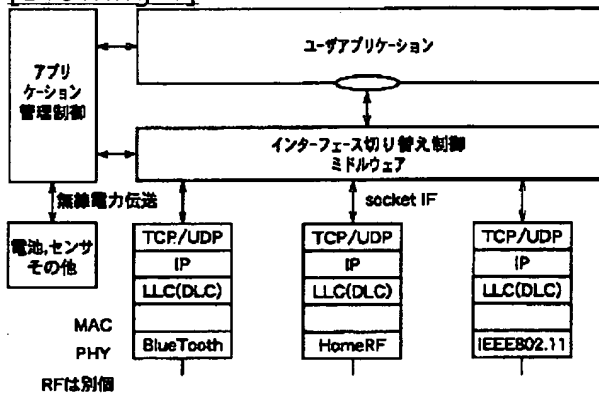


[Drawing 3]

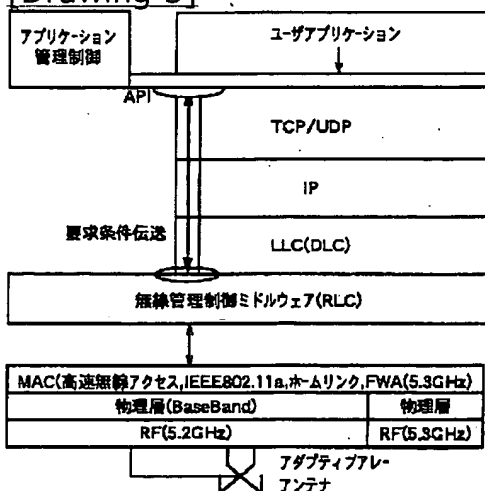
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[Drawing 4]



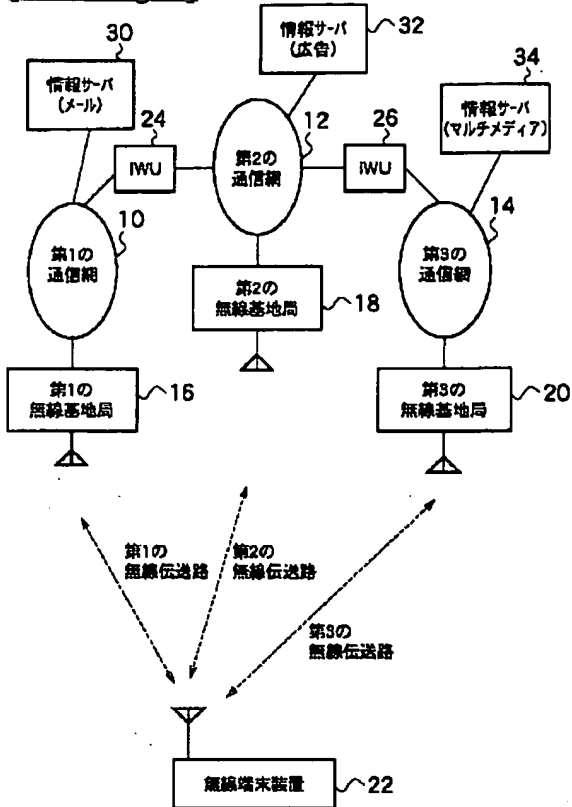
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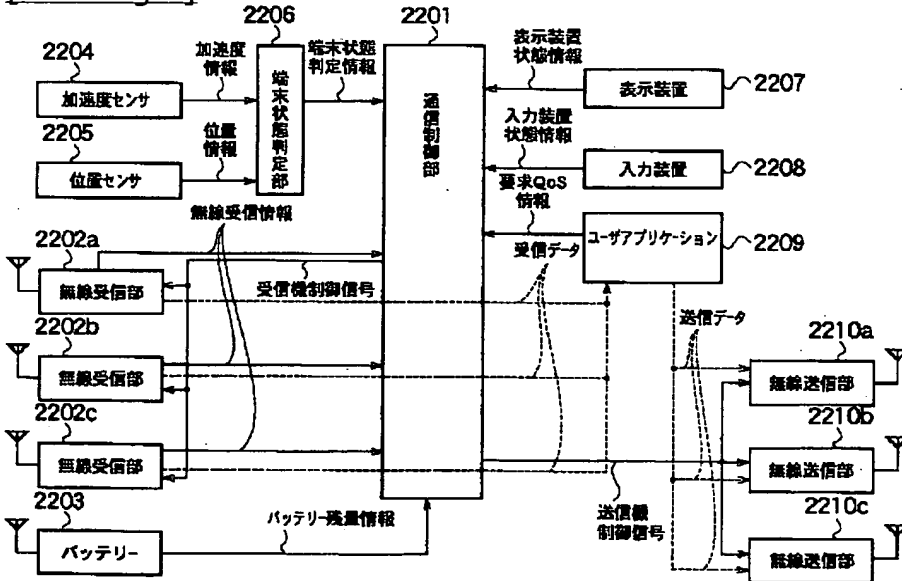
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[Drawing 6]

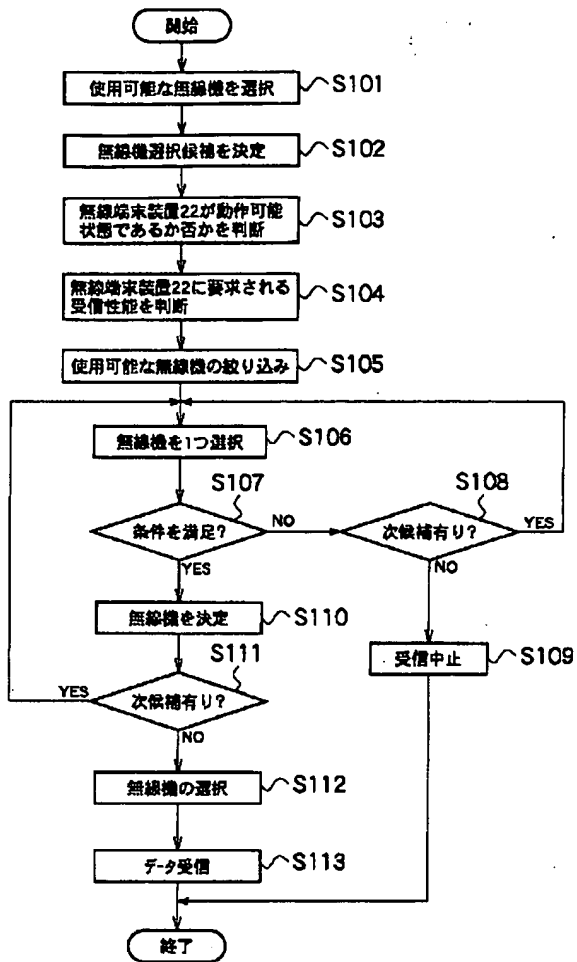


[Drawing 7]



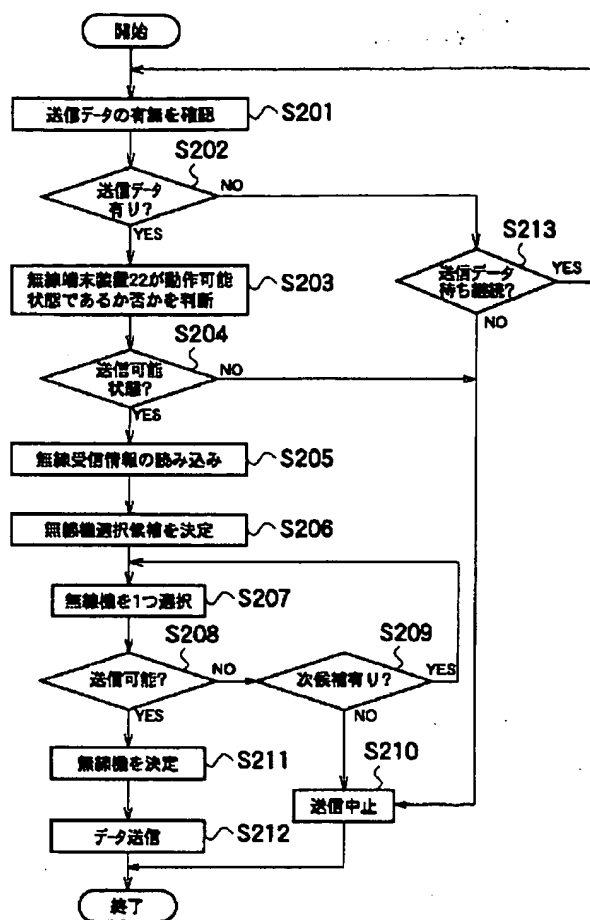
[Drawing 8]

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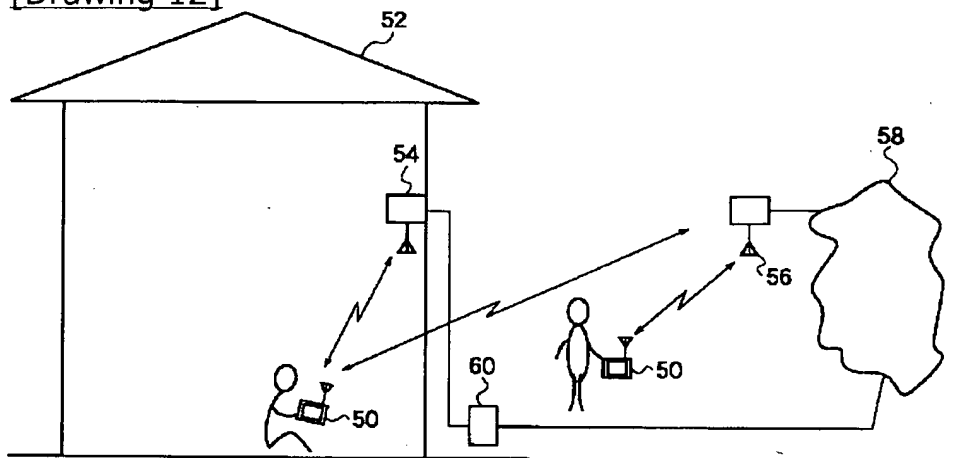


[Drawing 9]

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[Drawing 12]



[Drawing 10]

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(a)

	伝送速度	通信時間	時間単価	コスト	優先順位
通信路 1	a	$M/a$	A	$\frac{A}{a} M$	②
通信路 2	b	$M/b$	B	$\frac{B}{b} M$	①
通信路 3	c	$M/c$	C	$\frac{C}{c} M$	③

⇒

(a=b=cとも.キャリア選択)

(b)

	通信料金体系	限界コスト	優先順位
通信路 1	時間課金	$\frac{A}{a} M$	③
通信路 2	パケット課金	$\frac{M}{I} P$	②
通信路 3	定額制	0	①

⇒

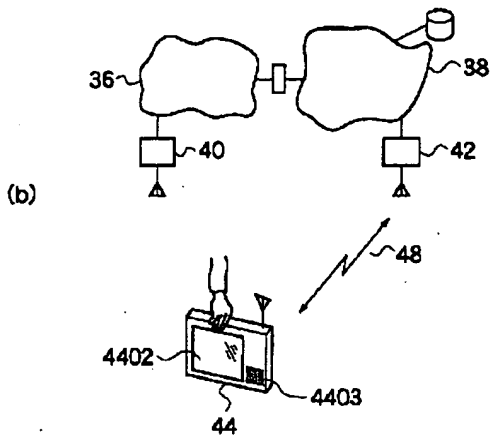
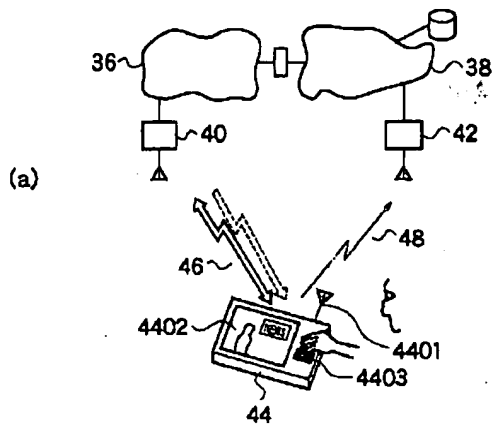
(c)

コンテンツ内容	選択通信路
定型コンテンツ	通信路 1
従来型コンテンツ	通信路 3→通信路 2

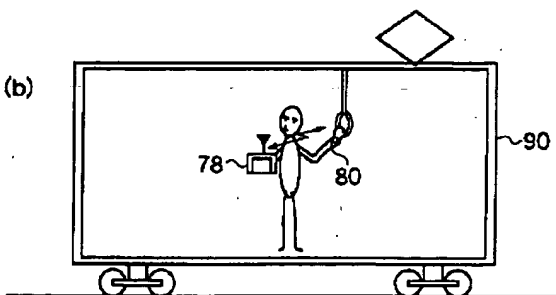
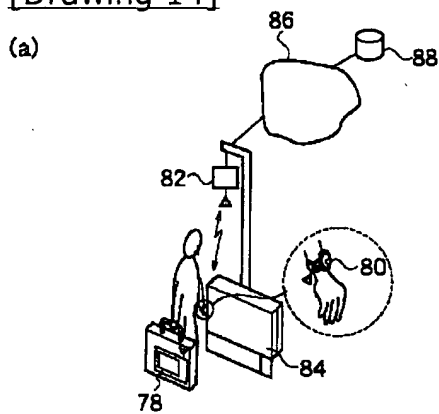
[Drawing 11]

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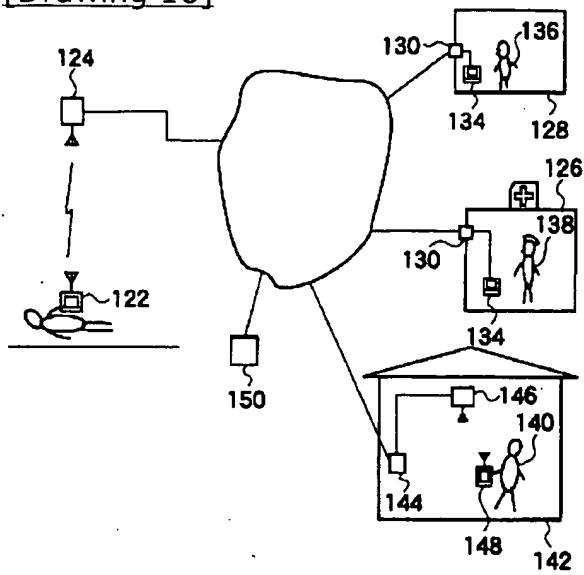


[Drawing 14]

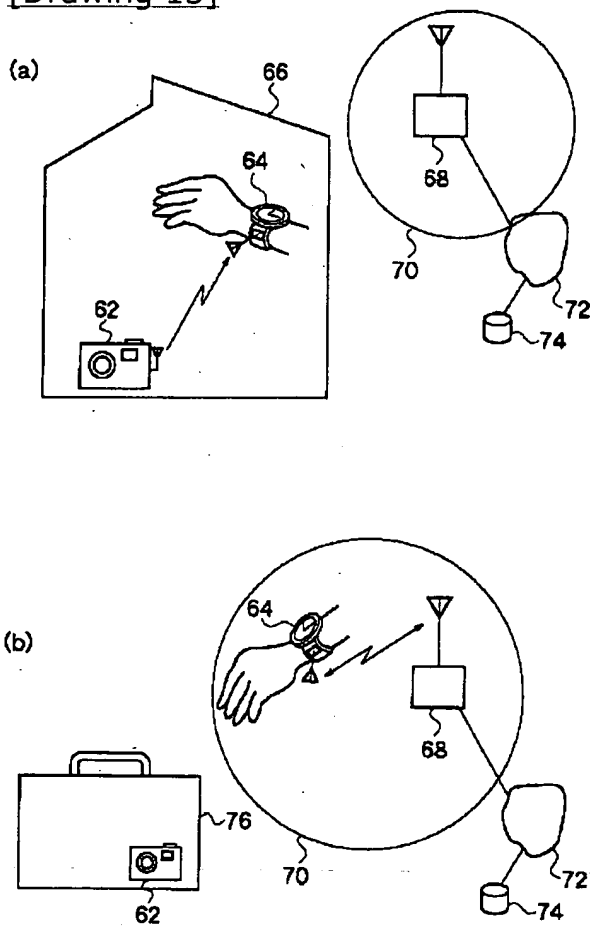


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[Drawing 16]

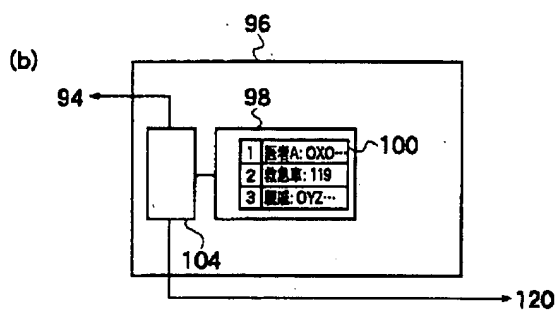
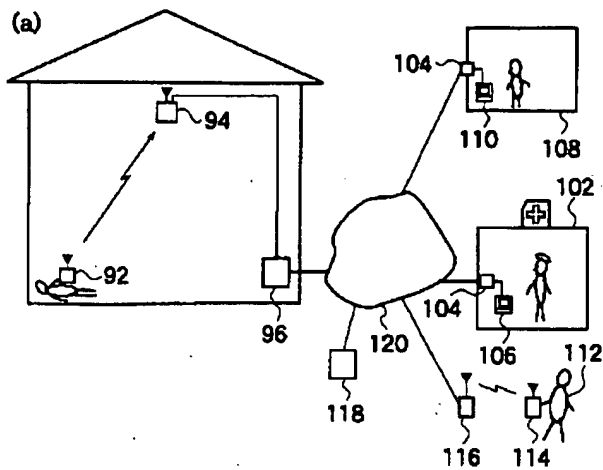


[Drawing 13]

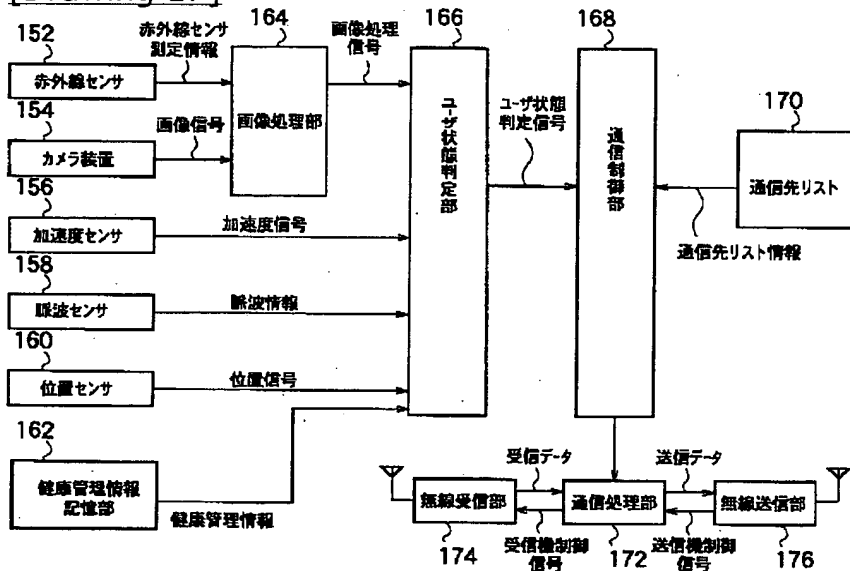


[Drawing 15]

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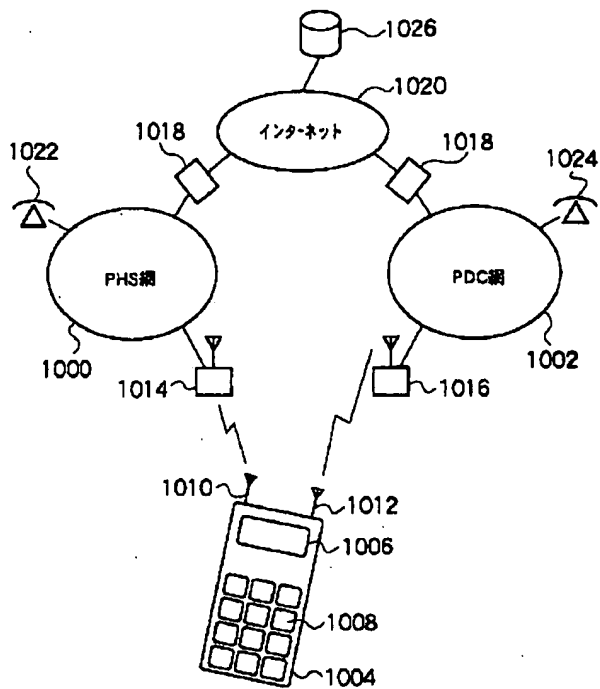


[Drawing 17]

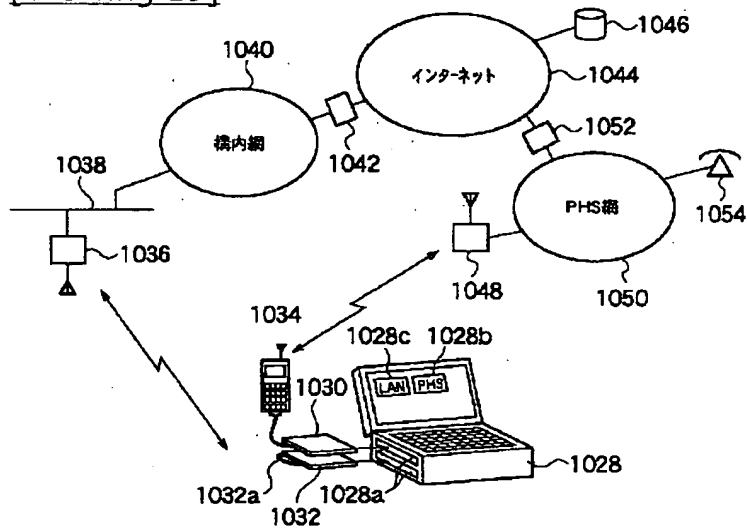


[Drawing 18]

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[Drawing 19]



[Translation done.]

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